Pest Management Research Report - 1997

an annual compilation of information garnered by researchers
in the area of crop and animal protection
materials, strategies and methods.

Re: Pest Management Research Report - 1997

The Official Title of the Report

1997 Pest Management Research Report - 1997 Growing Season: Compiled for the Expert Committee on Integrated Pest Management, by Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, Ontario, Canada N5V 4T3.
February, 1998.
Published on diskette and Internet at http://res.agr.ca/lond/pmrc/pmrchome.html.

What is on the diskette?

There are four WordPerfect 6 text files on this diskette or with this Email.
97CONTENTS (1) contains the title page and **TABLE OF CONTENTS**.
97INSECTS.REP (2) contains the entomology sections.
97DISEASE.REP (3) contains the diseases, nematode and the biological control practices sections
97INDEXS.LIS (4) contains 7 indices and 1 list for the 1997 reports:

- Index 1. Crop/Host
- Index 2. Pests
  - 2a. Insects/Mites
  - 2b. Diseases
  - 2c. Nematodes
- Index 3. Pest Management and Biological Control Methods
- Index 4. Products
- Index 5. Authors
- Index 6. Establishments
- Index 7. Varieties or Breeding Lines Testing

List 1. Alternative or common names for pest control products and chemical compounds.

* Report and page numbers

To Read the Report The files can be read by any IBM or IBM compatible PC using WordPerfect software. Most PC will convert to Word. The files on diskette have been compressed with an executable program included to expand them. If you have any trouble accessing the files, please let me know and I will see if I can make appropriate changes for your system.

Contact Stephanie Hilton at
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To Print the Report
To print individual research reports, or the complete version of the report, WordPerfect will automatically reformat the file for your printer. The pitch and margin settings are stored as part of the document and should not be changed.

Note: Files (2 - 4) have sequential page numbers.

Procedures for the 1998 Annual Report will be sent in September, 1998, or contact Stephanie Hilton.

Sujet : Rapport de recherches sur la lutte dirigée - 1997

Titre officiel du document
1997 Rapport de recherches sur la lutte dirigée - pour le saison 1997. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, London (Ontario) Canada N5V 4T3. Février, 1998.

Publié sur disquette et l'Internet à http://res.agr.ca/lond/pmrc/pmrchome.html

Instructions pour l'utilisation de la disquette.
Cette disquette contient quatre fichiers de texte WordPerfect 6.
96CONTENTS (1) contient l'avant-propos et **LA TABLE DES MATIÈRES.**
96INSECTS.REP (2) contient les sections d'entomologie.
96DISEASE.REP (3) contient les sections sur les maladies, les nématodes et les pratiques biologiques, et l'appendice.
96INDEX.LIS (4) contient les sept indices* et une liste pour le Rapport de recherche:

1. Hôtes (cultures)
2. Ravageurs
    - 2a. insectes
    - 2b. maladies des plantes
    - 2c. Nematodes
3. Méthodes de lutte biologique
4. Produits (chimiques)
5. Auteurs
6. Établissements
7. Variéties

LISTE 1 contient les produits et les noms vulgaires.

*** numéros de rapport et numéros de page.**

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Si vous avez des probleme, contacter Stephanie Hilton à Tel. (519) 457-1470 Ext. 218
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On vous enverra les procédures pour l'année 1998 en septembre, 1998 ou s'il-vous-plaît contacter Stephanie Hilton au Centre de recherches du Sud sur la phytoprotection et les aliments à London.
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English

1997 PEST MANAGEMENT RESEARCH REPORT

Compiled for: THE EXPERT COMMITTEE ON INTEGRATED PEST MANAGEMENT
Chairperson: Hugh G. Philip, P.Ag.

Prepared by: Research Branch, Agriculture and Agri-Food Canada
Southern Crop Protection and Food Research Centre
London, Ontario, CANADA N5V 4T3

FEBRUARY, 1998

This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results, particularly of field trials, amongst researchers, the pest management industry, university and government agencies, and others concerned with the development, registration and use of effective pest management strategies. The use of alternative and integrated pest management products is seen by the ECIPM as an integral part in the formulation of sound pest management strategies. If in doubt about the registration status of a particular product, consult the Pest Management Regulatory Agency, Health Canada at 1-800-267-6315.

This year there were 133 reports. The Expert Committe on Integrated Pest Management is indebted to the researchers fromprovincial and federal departments, universitites, and industry who submitted reports, for without their involvement there would be no report. Our special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to Stephanie Hilton for editorial and computer compilation services.

Suggestions for improving this publication are always welcome.

French

RAPPORT DE RECHERCHE EN LUTTE DIRIGÉE 1997

Préparé pour: **LE COMITÉ D'EXPERTS SUR LA LUTTE INTÉGRÉE**
Président: **Hugh G. Philip, P.Ag.**

Préparé par: **Agriculture et agroalimentaire Canada**
Centre des recherches du Sud sur la phytoprotectin et les aliments
London, (Ontario) CANADA N5V 4T3

FÉVRIER 1998

La compilation du rapport annuel vise à faciliter la diffusion des résultats de la recherche dans le domaine de la lutte anti-parasitaire, en particulier, les études sur la terrain, parmi les chercheurs, l'industrie, les universités, les organismes gouvernementaux et tous ceux qui s'intéressent à la mise au point, à l'homologation et à l'emploi de stratégies antiparasitaires efficaces. L'utilisation de produits de lutte intégrée ou de solutions de rechange est perçue par Le Comité d'experts sur la lutte intégrée (CELI) comme faisant parti intégrante d'une stratégie judicieuse en lutte antiparasitaire. En cas de doute au sujet du statut d'enregistrement d'un produit donné, veuillez consulter Health Canada, Agence de Réglementation de la lutte anti-parasitaire à 1-800-267-6315.

Cette année, nous avons donc reçu 133 rapports. Les membres du Comité d'experts sur la lutte intégrée tiennent à remercierchaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs, qui ont fait la révision scientifique de chacun des rapports et en ont assuré la qualité, et Stephanie Hilton qui ont fourni les services d'édition et de compilation sur ordinateur.

Vos suggestions en vue de l'amélioration de cette publication sont toujours très appréciées.

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B - Vegetables and Special Crops/Légumes et cultures spéciales
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E - Cereal, Forage and Oilseed Crops/Céréales, cultures fourragères et oléagineux
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SECTION A - ENTOMOLOGY/ENTOMOLOGIE - TREE FRUIT AND BERRY CROPS /ARBRES FRUITIERS ET PETITS FRUITS

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- Pages 1 - 49

Section Editors: **J. Mike Hardman**
Dr. Bruce Neill

PMR REPORT # 1 **SECTION A: INSECT PESTS OF FRUIT**

CROP: Apples *Malus sylvestris* var. McIntosh
PEST: Oblique Banded Leafroller *Choristoneura rosaceana*

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TITLE: CONTROL OF OBLIQUE BANDED LEAFROLLER (OBLR) IN APPLES USING TWO APPLICATIONS OF SPINOSAD 480SC COMPARED TO TWO APPLICATIONS OF RIPCORD 400EC.

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), RIPCORD 400EC (cypermethrin).

METHODS: Each plot consisted of two trees in a single row and was replicated 4 times according to a randomized complete block design. Foliar application of the insecticides were made using an airblast sprayer that delivered 1000 L/ha at 300 PSI. On July 16, application one was applied which was 200 degree days (DD) after the first significant moth catch in the Georgian Bay area of Ontario. A second application was made 14 days later (July 30). Due to research permit requirements the rate of treatment 6 was reduced from 350 g ai/ha at application one, to 150 g ai/ha at application two. Assessments were made on August 7 and August 28. Assessments were made by inspecting 25 growing terminals (GTerm) and 25 non-growing terminals (NGTerm) from each plot and 50 fruit were inspected for fruit damage. All data were converted to percent infested terminals or percent damaged fruit. Data were analyzed using Duncan's Multiple Range Test (p• 0.05).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: All insecticide treatments significantly reduced the number of infested terminals and fruit damage compared to the untreated check.

Table 1. Comparisons of OBLR infested terminals and damaged fruit among SPINOSAD 480SC, RIPCORD 400EC, and an Untreated Check treatments.

Trt. #	Treatment Description	August 7			August 29		
		% Infest GTerm	% Infest NGTerm	% Fruit Damaged	% Infest GTerm	% Infest NGTerm	% Fruit Damaged
1	Untreated Check	25.0 a*	14.0 a	7.0 a	8.0 a	0.0 a	5.0 a
2	RIPCORD 250 ml prod/ha	4.1 b	0.1 b	0.8 b	0.0 b	0.0 a	2.0 b
3	SPINOSAD 87.5 g ai/ha	11.0 b	0.0 b	1.0 b	3.0 b	0.0 a	2.0 b
4	SPINOSAD 130 g ai/ha	11.0 b	0.0 b	2.0 b	2.0 b	0.0 a	1.5 b
5	SPINOSAD 175 g ai/ha	4.0 a	0.0 b	2.0 b	1.0 b	0.0 a	1.0 b
6	SPINOSAD 350 g ai/ha	8.0 b	0.0 b	0.0 b	2.0 b	0.0 a	2.0 b

* Means followed by the same letter do not significantly differ (p• 0.05).

PMR REPORT # 2

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 9207

CROP: Apples cv. Liberty/M9
PEST: Western flower thrips, *Frankliniella occidentalis* (Pergande)

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TITLE: CONTROL OF WESTERN FLOWER THRIPS IN APPLE ORCHARD BY SPINOSAD AND ADMIRE

MATERIALS: SPINOSAD (NAF85) (DowElanco, Canada), ADMIRE (imidacloprid) (Bayer)

METHODS: An orchard consisting of six blocks of 40, four to five year old, Liberty/M9 slender spindle apple trees was used in the study. Western flower thrips movement into the orchard was assessed using limb taps beginning at early tight cluster stage of blossom development. At the blossoms' pink stage, the number of total potential apples in each of ten labelled central trees per block were assessed. At 80% full bloom in the orchard, three limb taps on each of the labelled ten trees per block were used to determine pre-treatment western flower thrips infestation levels. Four days later (May 13) SPINOSAD and ADMIRE were each applied, at 100 ppm, to two replicated blocks of trees. Limbtaps were repeated three days post-insecticide treatments. SPINOSAD and ADMIRE were reapplied in the same blocks at similar rates in 14 days and posttreatment limbtaps repeated after two days. On June 20th, total fruit set was counted on each of the ten labelled trees per treatment including all apples on, and at the base of the tree, and the number of apples with western flower thrips damage, in the form of pansy spots, per total apples were counted.

RESULTS: The counts of pre-treatment western flower thrips indicated no significant ($P>0.05$) difference between the treatment and control trees (Table 1). Three days after the first treatments, the lower mean counts of western flower thrips within the two insecticide treatments were not significantly ($P>0.05$) lower than the mean counts in the control (Table 1). This may be a result of slow mortality that was not recognized after just three days. After the second treatment of both compounds, thrips counts were already naturally decreasing due to the loss of the blossoms. Significantly fewer western flower thrips were found in the SPINOSAD versus the control trees after the second treatment . There were significantly fewer western flower thrips damaged apples in both the SPINOSAD and ADMIRE treatments than in the control trees at harvest (Table 2).

There were no significant differences, between treatment and control blocks, in the total number of blossoms per tree prior to insecticide treatments (SPINOSAD $\bar{x}=24.4 \pm 2.6$; ADMIRE $\bar{x}=27.1 \pm 2.1$; CONTROL $\bar{x}=26.1 \pm 2.1$). At harvest there was no difference between both the number of apples set per tree and the arcsine transformation of the blossom set per total blossoms ratio.

CONCLUSION: Two applications of SPINOSAD in an apple orchard at 80% full to full bloom caused significant reductions in western flower thrips populations and both SPINOSAD and ADMIRE applications reduced resulting pansy spotted apples. Neither treatment caused a lower than normal proportion of successful blossom set, indicating that their application did not have an immediate detrimental effect on the pollenizing bees.

Table 1. Mean western flower thrips (WFT) per limbtap pre- and posttreatments with Spinosad and Admire. Replicated twice, n=10.

Date	Treatment	Mean WFT per limbtap ± S.E.
Pretreatment	SPINOSAD	5.05 ± 1.33 a*
	ADMIRE	4.35 ± 0.81 a
	control	6.10 ± 0.87 a
Posttreatment I	SPINOSAD	5.70 ± 1.67 a
	ADMIRE	4.00 ± 1.19 a
	control	8.15 ± 2.09 a
Posttreatment II	SPINOSAD	0.35 ± 0.13 b
	ADMIRE	1.10 ± 0.22 a
	CONTROL	1.55 ± 0.35 a

*means within date followed by different letters are different as determined by Duncan's multiple range test ($P<0.05$).

Table 2. Mean proportion of apples with western flower thrips induced 'pansy spots' per total apples determined June 20. Replicated twice, n=10 trees.

Treatment	Apples with pansy spots per total apples
SPINOSAD	0.03 ± 0.02 a *
ADMIRE	0.09 ± 0.05 b
control	0.12 ± 0.09 c

* means within date followed by different letters are different as determined by Duncan's multiple range test ($P<0.05$).

PMR REPORT # 3 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 306-1461-9007

CROP: Apple, cv. McIntosh
PESTS: Rosy apple aphid *Dysaphis plantaginea* Passerini, green apple aphid *Aphis pomi* DeGeer

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TITLE: ASSESSING EFFECTS OF NEWLY-REGISTERED INSECTICIDE/MITICIDES ON ROSY APPLE APHID

MATERIALS: MATADOR 120 EC (cyhalothrin-lambda), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a 11 yr-old block of McIntosh on MM111 rootstock planted at a spacing of 4.3 x 6.1 m. Pesticides were applied by a mistblower sprayer 25 June 1997 to plots of 9 trees in each of 2 adjacent rows (18 trees sprayed per treatment). Pesticides were diluted to a rate comparable to 600 litres/ha with 75 L sprayed on each plot. On each sampling date in July and August, we counted the number of live and dead colonies of rosy apple aphid (RAA) and green apple aphid (GAA) on each of six trees per treatment. The pretreatment count of 23 June was only done for live colonies of RAA (Table 1). On 15 September the number of apples injured by RAA per 50 fruit was counted for each of five trees per treatment (Table 3).

RESULTS: A precount of RAA colonies 2 days before treatment indicated average numbers varied from 5-10 per tree, and there were no significant differences (Table 1). Similarly after treatment there were no significant differences among treatments in numbers of live or dead colonies of green apple aphid and rosy apple aphid (Table 2). However on 3 July, 9 days after treatment, GAA and RAA colonies in the MATADOR trees were about 10% of the numbers found in the control trees. The highest number of dead aphid colonies, the unknowns, were in the trees treated 25 August with the higher rate of PYRAMITE. Because of high variation from tree to tree there were no significant differences in % of fruit with RAA injury (Table 1). However, there is the likelihood that both MATADOR and the higher rate of PYRAMITE protected fruit from aphid damage.

Table 1. Precount of number of live colonies of rosy apple aphid per tree on 23 June and the 15 September count of % of apples damaged by rosy apple aphid. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate/ha	No. of colonies 23 June	% damaged apples
PYRAMITE	300 g	5.00a	6.00a
PYRAMITE	600 g	7.83a	0.00a
MATADOR	230 mL	9.83a	0.00a
Control		8.33a	1.60a

Table 2. Number of live and dead colonies per tree of green apple aphid (GAA) and rosy apple aphid (RAA) and unknown dead aphid colonies (Unkn.). For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate/ha	GAA live	GAA dead	RAA live	RAA dead	Unkn. dead	GAA live	GAA dead	RAA live	RAA dead	Unkn. dead
				3 July					10 July		
PYRAMITE	300 g	4.50a	0.00a	5.00a	0.67a	0.00a	1.67ab	0.33a	7.33a	0.00a	1.00a
PYRAMITE	600 g	3.67a	0.00a	8.50a	0.33a	0.00a	2.50a	0.00a	8.00a	0.00a	0.17a
MATADOR	230 mL	0.67b	0.00a	1.83a	0.17a	0.00a	0.00b	0.00a	1.83a	0.50a	0.17a
Control		6.17a	0.00a	11.17a	0.00a	0.33a	4.33a	0.00a	3.33a	0.83a	1.67a
				24 July					25 Aug.		
PYRAMITE	300 g	5.67a	0.00a	2.83a	0.50a	0.00a	2.17a	0.67a	0.17a	0.00a	4.83b
PYRAMITE	600 g	5.67a	0.17a	2.67a	1.67a	0.67a	0.00b	0.17a	0.00a	0.67a	12.33a
MATADOR	230 mL	3.67a	0.00a	1.50a	0.17a	0.17a	0.00b	0.00a	0.00a	0.00a	2.67b
Control		1.67a	0.17a	0.17a	1.67a	2.00a	0.00b	0.50a	0.00a	0.00a	8.67ab

PMR REPORT # 4 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 306-1261-9006

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), apple rust mite (ARM), *Aculus schlechtendali* (Nalepa).
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: ASSESSING EFFECTS OF MITICIDES ON EUROPEAN RED MITE, APPLE RUST MITE AND A PHYTOSEIID PREDATOR MITE

MATERIALS: MATADOR 120 EC (cyhalothrin-lambda), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a 11 yr-old block of McIntosh on MM111 rootstock planted at a spacing of 4.3 x 6.1 m. Pesticides were applied by a mistblower sprayer 25 June 1997 to plots of 9 trees in each of 2 adjacent rows, i.e. 18 trees per treatment. Each set of 18 trees was sprayed with 75 L of solution. Pesticides were diluted to a rate comparable to 600 litres/ha. Samples of 20 leaves from each of six trees per block were taken on the dates shown below and passed through a mite-brushing machine. Petri dish bioassays done in 1997 with a discriminating dose of pyrethroid (70 ppm cypermethrin) indicated this portion of the orchard is populated by the native pyrethroid-susceptible strain of the phytoseiid predator mite *Typhlodromus pyri*. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factors of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* and *A. schlechtendali* were from 1/16th of the plate.

RESULTS: Counts of active stages (RM) and summer eggs (RME) of European red mite remained < 1 per leaf all summer in all plots, probably because of feeding by *T. pyri* (Table 1). For all three sampling dates in July, counts of apple rust mite were significantly lower in the two PYRAMITE blocks and the MATADOR block than in the untreated control, indicating high toxicity of both materials to the apple rust mite. Counts of *T. pyri* on trees treated with the pyrethroid MATADOR or the higher (600 g) rate of PYRAMITE were lower than on the control trees for 3 out of 4 sampling dates. On two dates *T. pyri* counts were lower than control on trees sprayed with the lower rate of PYRAMITE. The higher rate of PYRAMITE also caused significant long-term suppression but the lower rate of PYRAMITE allowed a relatively high density of the predator to persist through the summer.

Table 1. Densities of eggs (RME) and active stages (RM) of European red mite and active stages of *T. pyri*. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate/ha	RME	RM	ARM	TP
			10 July		
PYRAMITE	300g	0.00a	0.00a	0.83b	0.73a
PYRAMITE	600 g	0.00a	0.00a	3.67b	0.30a
MATADOR	230 mL	0.00a	0.00a	1.13b	0.04a
Control		0.00a	0.00a	26.56a	0.43a
			21 July		
PYRAMITE	300 g	0.00a	0.00a	1.97b	0.86a
PYRAMITE	600 g	0.00a	0.17a	0.00b	0.34b
MATADOR	230 mL	0.00a	0.00a	0.83b	0.09b
Control		0.00a	0.00a	97.16a	1.30a
			29 July		
PYRAMITE	300 g	0.00a	0.00a	0.69b	0.91b
PYRAMITE	600 g	0.17a	0.17a	1.19b	0.13b
MATADOR	230 mL	0.00a	0.00a	0.17b	0.00b
Control		0.17a	0.00a	44.17a	3.13a
			26 Aug		
PYRAMITE	300 g	0.00b	0.00a	0.70a	0.75b
PYRAMITE	600 g	0.17ab	0.00a	1.17a	0.09c
MATADOR	230 mL	0.83a	0.17a	4.83a	0.04c
Control		0.00b	0.00a	1.33a	3.60a

PMR REPORT # 5 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 306-1261-9006

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), apple rust mite (ARM), *Aculus schlechtendali* (Nalepa).
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: ASSESSING EFFECTS OF MITICIDES ON EUROPEAN RED MITE AND A PHYTOSEIID PREDATOR ON PYRETHROID-TREATED APPLE TREES

MATERIALS: AGRI-MEK 1.9% EC (Abamectin), SUPERIOR OIL 70 (acaricidal petroleum oil), PYRAMITE 75 WP (pyridaben), RIPCORD 400 EC (cypermethrin)

METHODS: The trial was conducted in a 19 yr-old block of McIntosh on Beautiful Arcade rootstock planted at a spacing of 2.1 x 6.1 m. The block included four rows of 20-40 trees. RIPCORD, a pyrethroid insecticide, at 125 mL/ha was applied by mistblower to all trees 26 May 1997. Each of the other treatments were applied 25 June 1997 to one of three plots that each comprised half the trees in two adjacent rows (Table 1). A fourth plot of two half rows served as an untreated control. Pesticides were diluted to a rate comparable to 600 litres/ha. Samples of 20 leaves from each of five trees per plot were taken on the dates shown below and passed through a mite-brushing machine. Note that the 18 June count was taken before treatments. Counts of the phytoseiid predator *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factors of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate. This orchard had been inoculated with several thousand pyrethroid/organophosphate resistant *T. pyri* (the New Zealand strain) in the late summer of 1995 and again in March of 1996.

RESULTS: Before treatment there were more eggs of the European red mite (RME) in the AGRI-MEK plot than in the others (Table 1). Nine days after treatment (4 July) there were more red mite eggs in the AGRI-MEK and one of the PYRAMITE plots than in the control. However, on all subsequent dates there were fewer red mites in the treated plots than in the control, where the density increased steadily to 37 active mites per leaf by 25 August. Both PYRAMITE and the mixture of SUPERIOR OIL and AGRI-MEK gave season-long control of red mite keeping counts of active stages less than the economic threshold of 5 mites per leaf. Low numbers of *T. pyri* were detected despite the application of cypermethrin in the spring. These predators probably helped prevent mite resurgence after the miticide treatments.

Table 1. Densities of eggs (RME) and active stages (RM) of European red mite and active stages of *T. pyri*. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate/ha	RME	RM	TP	RME	RM	TP
			18 June			18 July	
PYRAMITE	300 g	0.98c	0.04a	0.00a	0.60b	0.00c	0.00a
PYRAMITE	600 g	9.40b	0.20a	0.00a	1.00b	0.00c	0.41a
AGRI-MEK +	750 mL	30.96a	0.88a	0.00a	4.80b	2.00b	0.05a
SUPERIOR OIL	10 L						
Control		6.40b	0.00a	0.00a	64.40a	11.00a	0.15a
			4 July			25 July	
PYRAMITE	300 g	1.40b	0.00d	0.00a	0.00b	0.00b	0.00a
PYRAMITE	600 g	19.40a	1.40c	0.15a	0.00b	0.00b	0.00a
AGRI-MEK +	750 mL	11.67a	2.42b	0.00a	0.18b	0.40b	0.00a
SUPERIOR OIL	10 L						
Control		2.20b	4.40a	0.00a	8.20a	20.40a	0.00a
			11 July			30 July	
PYRAMITE	50 g	0.00c	0.00b	0.00a	0.00b	0.00b	0.00a
PYRAMITE	100 g	2.60b	0.40b	0.00a	0.00b	0.00b	0.21a
AGRI-MEK +		4.60b	1.40b	0.05a	0.00b	1.36b	0.00a
SUPERIOR OIL	10 L						
Control		15.40a	5.80a	0.05a	11.76a	21.85a	0.00a
			25 Aug.				
PYRAMITE	50 g	0.80b	1.20b	0.36a			
PYRAMITE	100 g	0.60b	0.20c	0.05a			
AGRI-MEK +	750 mL	0.60b	4.20b	0.26a			
SUPERIOR OIL	10 L						
Control		10.70a	37.18a	0.00a			

PMR REPORT# 6 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 306-1261-9006

CROP: Apple, cv. McIntosh
PESTS: European red mite *Panonychus ulmi* (Koch), twospotted spider mite *Tetranychus urticae* Koch, apple rust mite *Aculus schlechtendali* (Nalepa).
PREDATORS: *Typhlodromus pyri* (TP) Scheuten, *Zetzellia mali* (Ewing) (ZM).

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TITLE: **COMPATABILITY OF SEVERAL PESTICIDES WITH CONTROL OF MITES BY PREDATORS ON APPLE**

MATERIALS: DIPEL WP (*Bacillus thuringiensis* var. *kurstaki* Berliner), ADMIRE 240 F (imidacloprid), CYGON 480 EC (dimethoate), PIRIMOR 50 DF (pirimicarb), RIPCORD 400 EC (cypermethrin), MAESTRO 75 DF (captan), NOVA 40 W (myclobutanil), CONFIRM 240 F (tebufenozide).

METHODS: Trials were conducted in 1996 on six 0.2 ha plots each consisting of two rows of semi-dwarf 10 yr-old Summerland McIntosh trees (19-20 trees per row) and two rows of 2 yr-old Hartenhof Cortland trees on MM111 rootstocks. All sprays were done with a mistblower. Plots under the Integrated Fruit Production regime (IFP) were sprayed with one half the amount of pesticide per hectare recommended for a standard tree row volume because the measured volume in this orchard was only about 50% of standard. Trees in the Integrated Pest Management (IPM) plots and the Cygon plots were sprayed with the full recommended rates of pesticide per hectare. Pesticides were diluted according to a spray volume of 800 L/ha. Dates of application of insecticides to the McIntosh trees are shown in Table 1. (The Cortlands were only sprayed with fungicide). In addition, recommended rates of MAESTRO and NOVA, chosen because of their compatability with the phytoseiid predator mite *Typhlodromus pyri*, were applied as needed to control apple scab. Samples of 25 leaves per tree from 5 McIntosh trees per plot were taken on the dates shown below and passed through a mite-brushing machine. These trees had each been inoculated in 1993 with 100 pyrethroid/organophosphate-resistant *T. pyri* imported from New Zealand. Since 1988 the imported *T. pyri* had been cultured in Nova Scotia on potted trees in a screenhouse and subjected to annual pyrethroid treatments. Counts of the phytoseiid predator *T. pyri* and the stigmaeid predator *Z. mali* were based on numbers on half of the glass collecting plate (i.e. equivalent to 12.5 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate.

RESULTS: The results are summarized in Table 2.

CONCLUSIONS: After the first sampling date in late June, counts of *T. pyri* were often lower in the plots sprayed with CYGON than in those under the IPM and IFP regimes. With the IPM and IFP regimes *T. pyri* (with some help from *Z. mali*) were able to keep *P. ulmi* below the economic threshold of 5 motile mites per leaf. There was also good control of apple rust mite: counts were always < 10 per leaf- well below the threshold of ca 300 per leaf. Twospotted mites were also suppressed. Hence all insecticides used in these regimes (ADMIRE, CONFIRM, DIPEL, PIRIMOR, RIPCORD and SEVIN) were compatible with biological control of mites by the New Zealand strain of *T. pyri*. Conversely in plots C and H which were sprayed with CYGON, *T. pyri* counts were lower than in the other plots and counts of *P. ulmi* were above the economic threshold on the last 3 sampling dates (1 August- 5 September).

Table 1. Pesticide treatments applied in the 1996 orchard trial.

Treatment	Rate g AI /ha	REGIME (PLOTS) Date applied	Target
		IFP (I, J)	
CONFIRM 240 F		12 June	WM, PALR
ADMIRE 240 FS	48	24 June	RAA, AA
		IPM (D, E)	
RIPCORD 400 EC	5	12 June	WM, PALR
+ DIPEL WP	560		
PIRIMOR 50 DF	850	24 June	RAA, AA
		CYGON (C, H)	
RIPCORD 400 EC	5	12 June	WM, PALR
+ DIPEL WP	560		
CYGON 480 EC	1632	24 June	RAA, AA
CYGON 480 EC	480	20 August	AM
		THINNING (C, E, I)	
SEVIN XLR PLUS 480 S	2400	12 June	Fruit thinning

* Targets of the insecticides are WM- winter moth, PALR- pale apple leafroller, RAA- rosy apple aphid, AA- apple aphid and AM- apple maggot.

Table 2. Mean number of mites per leaf (RME, RM- eggs & motile European red mite; TSSME,TSSM- eggs and motile two-spotted spider mite; ARM, TP, ZM- motile stages of apple rust mite, *T. pyri* and *Z. mali* respectively).

Regime	Plot	RME	RM	TSSME	TSSM	ARM	TP	ZM
				27 June				
IFP	I	0.00c	0.00c	0.00a	0.00a	0.16b	0.08a	0.00a
IFP	J	1.12b	1.12ab	0.00a	0.16a	0.00b	0.30a	0.00a
IPM	D	0.00c	0.00c	0.00a	0.00a	0.00b	0.31a	0.04a
IPM	E	0.00c	0.16bc	0.00a	0.00a	0.16b	0.04a	0.03a
CYGON	C	0.59b	0.79bc	0.00a	0.00a	0.00b	0.00a	0.00a
CYGON	H	3.23a	1.13a	0.00a	0.00a	2.63a	0.00a	0.06a
				15 July				
IFP	I	0.48b	0.00a	0.00a	0.00a	0.96b	1.07ab	0.00a
IFP	J	11.90a	0.33a	0.00a	0.48a	0.48b	1.97ab	0.08a
IPM	D	0.00b	0.00a	0.00a	0.00a	0.20b	3.11a	0.04a
IPM	E	0.48b	0.00a	0.00a	0.00a	0.48b	1.61ab	0.05a
CYGON	C	17.20a	0.60a	0.00a	0.60a	1.20b	0.10b	0.00a
CYGON	H	15.84a	0.40a	0.00a	0.59a	39.60a	0.05b	0.16a
				1 Aug.				
IFP	I	0.97cd	0.81c	0.16a	0.00a	5.05b	2.00b	0.03b
IFP	J	3.04c	0.64c	0.00a	0.00a	0.16c	3.34a	0.06b
IPM	D	0.83cd	0.00c	0.00a	0.00a	3.23bc	3.07a	0.04b
IPM	E	0.64d	0.16c	0.00a	0.00a	0.00c	1.24b	0.02b
CYGON	C	22.24a	23.20a	0.00a	2.08a	5.92b	0.00c	0.16b
CYGON	H	14.61b	16.05b	0.64a	1.94a	83.39a	0.04c	0.37a
				15 Aug.				
IFP	I	3.68c	1.28c	0.16a	0.16a	0.32b	2.06b	0.03b
IFP	J	1.44cd	0.96c	0.00a	0.00a	0.00b	3.09a	0.14b
IPM	D	2.15cd	0.99c	0.60a	0.00a	0.00b	1.43b	0.00b
IPM	E	0.16d	0.16c	0.00a	0.00a	0.16b	0.49c	0.05b
CYGON	C	37.60a	35.84a	0.00a	0.00a	2.56b	0.41c	0.30b
CYGON	H	16.64b	15.52b	0.00a	0.48a	126.08a	0.25c	1.12a
				5 Sept.				
IFP	I	1.12a	0.16c	0.00b	0.00b	0.32b	4.41a	0.08c
IFP	J	0.32a	0.00c	0.00b	0.00b	0.00b	3.30a	0.05c
IPM	D	0.40a	0.20c	0.00b	0.00b	0.00b	1.34b	0.02c
IPM	E	0.32a	0.00c	0.00b	0.00b	0.00b	0.87b	0.08c
CYGON	C	1.03a	10.17a	0.34a	0.34a	21.17a	0.08c	1.93a
CYGON	H	1.13a	2.59b	0.00b	0.00b	2.47b	0.12c	1.29b

PMR REPORT# 7 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 306-1261-9006

CROP: Apple, cv. Jonagold
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), two-spotted spider mite (TSSM), *Tetranychus urticae* Koch.
PREDATORS: *Typhlodromus pyri* (TP) Scheuten, *Zetzellia mali* (Ewing) (ZM).

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TITLE: EFFECTS OF ADMIRE AND RIPCORD ON PEST AND PREDATOR MITES ON POTTED APPLE TREES

MATERIALS: ADMIRE 240 F (imidacloprid) 400 mL/ha, RIPCORD 400 EC (cypermethrin) 125 mL/ha (full orchard rate) and 12.5 mL/ha (tenth rate).

METHODS: Trials were done with 1.6 m tall, 3 yr-old potted Jonagold trees. In 1995 these trees had been treated with the pyrethroid cypermethrin to annihilate native pyrethroid-susceptible *T. pyri* and then they were inoculated with a pyrethroid-resistant strain of *T. pyri* imported from New Zealand. Two sets of nine potted trees were held in one compartment and two sets in another compartment of an outdoor screenhouse that had a rain-proof sloping roof. For the first phase of the trial (19 August-16 September 1996) all trees within a set were touching, allowing mites to crawl among trees within a set. But sets were spaced at least 1 m apart, well beyond the spread of branches, to prevent mite dispersal by crawling. On each sampling date, one leaf was taken from each tree. Hence data for each set were recorded as total mites on nine leaves per set and there was no replication within a set. Statistical tests were only done for the second phase of the trial, after mid-September, when trees within a set were divided into three physically separated subsets ("plots"). From each tree three leaves were sampled, so mite counts were recorded as total mites on nine leaves per plot. Hence there were three plots per set. Insecticide solutions were applied to runoff as a mist using a 5 L single nozzle backpack sprayer pressurized by a handpump. Solutions were prepared assuming a volume of 3000 L spray solution per ha. RIPCORD solutions were applied 27 August and ADMIRE was applied 19 September.

RESULTS: Pretreatment counts of mites (19 August) indicated few phytophagous mites but high mean counts of predators: 2-4 *T. pyri* and 0-0.8 *Z. mali* per leaf (Table 1). Counts over the interval 28 August (1 d after application) to 16 September (20 d) suggest fewer *T. pyri* in sets A and C, which had the full rate of RIPCORD (125 mL/ha) than in sets B and D which were treated with the tenth rate (12.5 mL/ha). There was no effect of RIPCORD concentration on densities of *Z. mali*, European red mite or two-spotted spider mites. Mite counts after ADMIRE application did not show any significant toxic effects of ADMIRE on either *T. pyri* or *Z. mali*.

CONCLUSIONS: Data from this study confirms orchard trials which indicate neither RIPCORD nor ADMIRE interfere with biological control of phytophagous mites by the pyrethroid-resistant strain of *T. pyri*.

Table 1. Mean mite densities per leaf before and after the RIPCORD treatments of 27 August 1996

		19 Aug.				28 Aug.			
RIPCORD	Set	ERM	TSSM	TP	ZM	ERM	TSSM	TP	ZM
Full	A	0.00	0.33	2.67	0.00	0.33	0.22	2.33	0.22
Tenth	B	0.00	0.00	4.33	0.33	0.00	0.00	2.00	0.11
Full	C	0.00	0.00	4.44	0.78	0.00	0.00	2.00	0.44
Tenth	D	0.00	0.00	2.22	0.44	0.22	0.00	2.44	0.89

		3 Sept.				10 Sept.			
RIPCORD	Set	ERM	TSSM	TP	ZM	ERM	TSSM	TP	ZM
Full	A	0.56	0.00	1.67	0.00	0.22	0.00	0.78	0.00
Tenth	B	0.00	0.00	3.67	1.00	0.00	0.00	1.33	0.56
Full	C	0.00	0.00	0.89	0.44	0.00	0.00	0.67	0.22
Tenth	D	0.00	0.00	5.00	0.78	1.33	0.00	0.89	1.89

		16 Sept.			
RIPCORD	Set	ERM	TSSM	TP	ZM
Full	A	0.00	0.00	1.33	0.11
Tenth	B	0.00	0.00	1.44	1.67
Full	C	0.00	0.00	0.78	0.00
Tenth	D	0.00	0.00	1.44	0.89

Table 2. Mean mite densities per leaf after the ADMIRE application of 19 September 1996. For each mite species on each date, means followed by the same letter are not different ($P = 0.05$) according to the Waller-Duncan *k* ratio *t* value after square root transformation of the mite counts.

ADMIRE	RIPCORD	Set	ERM	TSSM	TP	ZM
				23 Sept.		
Full	Full	A	0.85a	0.00a	1.33a	0.00b
Full	Tenth	B	0.15a	0.19a	1.37a	0.96a
None	Full	C	0.00a	0.00a	0.67a	0.48ab
None	Tenth	D	0.00a	0.00a	1.04a	0.85a
				3 Oct.		
Full	Full	A	0.04a	0.00b	0.19a	0.04a
Full	Tenth	B	0.00a	1.00a	0.63a	0.03a
None	Full	C	0.00a	0.00b	0.33a	0.00a
None	Tenth	D	0.00a	0.07ab	0.89a	0.11a

PMR REPORT # 8 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 353-1461-9007

CROP: Apple, cv. Red Delicious
PEST: Apple leafcurling midge, *Dasineura mali* (Kieffer) (Diptera: Cecidomyiidae)

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TITLE: EFFICACY OF SPINOSAD, MALATHION 25 WP, RIPCORD 400 EC, AND SEVIN XLR PLUS AGAINST APPLE LEAFCURLING MIDGE ADULTS.

MATERIALS: SPINOSAD 480 (NAF 85, Spinosyn A & D), MALATHION 25 WP (malathion), RIPCORD 400 EC (cypermethrin), SEVIN XLR PLUS 480SC (carbaryl)

METHODS: Experiment 1. Uniform-sized Red Delicious leaves were picked from an insecticide-free orchard at the Atlantic Food and Horticulture Research Centre, Kentville, Nova Scotia. The following products were tested (ai/ha): (a) SPINOSAD 480 at 630g (b) MALATHION 25 WP at 875g, (c) RIPCORD 400 EC at 50g, (d) SEVIN XLR PLUS 480 SC at 1560 mL, and (e) water check. Three leaves were submerged in each of the solutions and allowed to dry before being placed in a 14 cm dia. culture dish with 5 male and 5 female apple leaf midge. A sheet of moistened 12.5 cm filter paper was also included in the culture dish. The adult *D. mali* used had eclosed less than 12 hrs before experiments were started. The experiment was started 8 hours after the onset of the photophase and run in a 16L:8D lighting regime (photoperiod onset: 0500), 21°C, and 75% RH.

Experiment 2. The same methods were used for experiment 2 except no moistened filter paper was included in the culture dishes. The following MALATHION 25 WP (rates g ai /ha) were tested: 875, 625, 375, 186 and (e) distilled water as a check.

For both experiments, each treatment was replicated 3 times and dead adults were recorded every hour for the first 6 hours of exposure and again after 24 hours. Mean percent dead adults was calculated for each exposure period and separated with Duncan's multiple range test.

RESULTS: In experiment 1, MALATHION and RIPCORD were 97% effective after 6 hours. After 24 hours, SPINOSAD, MALATHION, RIPCORD, and SEVIN were 27%, 100%, 100%, and 37% effective, respectively (Table 1).

In experiment 2 after 6 hours, MALATHION rates (g ai/ha) 875, 625, 375, and 186 were 100%, 100%, 93%, and 83% effective, respectively. After 24 hours the above rates were all 100% effective (Table 2). The water check was significantly less effective than MALATHION or RIPCORD after at least 2 hrs of exposure.

To view graphs of these results and others refer to the apple leaf midge WWW factsheet at http://res.agr.ca/kentville/pubs/fact12.htm.

CONCLUSIONS: The adults are short-lived and lay most of their eggs soon after emergence; therefore, a fast-acting product is desirable. The 375 g/ai/ha rate of MALATHION 25 WP gave effective control after 6 hrs and all rates of MALATHION gave 100% control after 24 hours.

Table 1. Experiment 1. Efficacy of various products on the apple leaf midge, *Dasineura mali*.

	Exposure time (hrs.)						
Treatment*	1	2	3	4	5	6	24
	Mean ± (SE) percent dead adult midge**						
RIPCORD	50(21)a	80(15)a	93(3)a	97(3)a	97(3)a	97(3)a	97(3)a
MALATHION	27(7)ab	43(13)b	73(13)b	77(12)b	93(3)a	97(3)a	100(0)a
SEVIN	0 (0)b	0(0)c	0(0)c	0(0)c	0(0)c	0(0)c	37(9)b
SPINOSAD	0 (0)b	0(0)c	0(0)c	3(3)c	3(3)c	7(3)bc	27(3)b
CHECK	0 (0)b	0(0)c	3(3)c	3(3)c	17(7)b	17(7)b	20(6)b

**Means within a column followed by the same letter are not significantly different. Duncan's multiple range test, P• 0.05.

Table 2. Experiment 2. Efficacy of various MALATHION 25 WP rates on the apple leaf midge, *Dasineura mali*.

	Exposure time (hrs.)						
	1	2	3	4	5	6	24
Treatment g/ai/ha	Mean ± (SE) cumulative percent dead **						
875	23(7)ab	70(15)a	93(3)a	100(0)a	100(0)a	100(0)a	100(0)a
625	33(7)a	67(9)a	90(6)a	97(3)a	100(0)a	100(0)a	100(0)a
375	30(0)ab	57(3)a	73(3)ab	80(0)ab	83(3)ab	93(3)a	100(0)a
186	10(10)bc	20(15)b	40(25)b	63(13)b	77(12)b	83(9)a	100(0)a
CHECK	20(0)c	20(0)b	20(0)c	20(0)c	30(6)c	43(9)b	93(12)b

**Means within a column followed by the same letter are not significantly different. Duncan's multiple range test, P• 0.05.

PMR REPORT # 9 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-Banded Leaf Roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF OBLIQUE-BANDED LEAF ROLLER ON APPLE WITH VARIOUS INSECTICIDES

MATERIALS: CONFIRM 240F (tebufenozide), DECIS 5 EC (deltamethrin), ORTHENE 75 WP (acephate), PYRIFOS 50 WP (chlorpyrifos)

METHODS: The trial was conducted in a 22-year-old orchard in the Grimsby, Ontario area; trees cv. Red Delicious were spaced 1.5 m by 3.0 m, and were on M26 rootstock. Treatments were replicated three times and assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. Three protocols were followed for CONFIRM; the first program was applied 100 DD (base 6.1C) after first male moth catch (7 July), and replicated 14 days (21 July) and 28 days (5 August) after first application. The second program was applied 200 DD after first male moth catch (14 July); the third was also applied 200 DD after first male moth catch, but the rate was increased to 360 g active ingredient/ha. The DECIS, ORTHENE, AND PYRIFOS treatments were also applied 200 DD after first male moth catch. All 200 DD treatments were repeated on 29 July, 15 days after initial application. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 7-8 L of spray mix were used per plot; pressure was set at 2000 kPa. On 25 July and 11 August, 60 terminals were examined per plot, and the number of terminals containing live larvae was recorded; 100 apples per plot were also examined on the tree, and the number of damaged fruit was recorded. On 16 September, 100 apples per plot were harvested and the damaged fruit were separated into first generation, second generation, and total fruit damage. Efficacy ratings were expressed as percent terminals infested, and percent damaged fruit, consisting of first generation, second generation, and total damaged fruit. Data were transformed (square root (x+½)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in tables 1 and 2. No phytotoxic effects were observed in any of the treated plots. Average fruit density was 129 apples/tree.

CONCLUSIONS: In the sample taken 25 July to assess the effects of treatments on infestations in terminals, none of the treatments were significantly different from the control; in the 11 August sample of terminals, all treated plots showed significantly lower terminal infestation than the control.
The DECIS, ORTHENE, AND PYRIFOS treatment programs consistently reduced fruit damage over the course of the season. Meanwhile, the various CONFIRM treatment programs were inconsistent; the percent damaged fruit was reduced in each sample, but the reductions were not always significantly

different from the control.

Table 1. Percent terminals infested per plot.

Treatment	Rate (a.i./ha)	Sample 1 July 25	Sample 2 August 11
DECIS 5 EC[1]	10.0 g	11.7 a[3]	1.1 b
PYRIFOS 50 WP[1]	1.7 kg	5.6 a	3.3 b
ORTHENE 75 WP[1]	1.3 kg	5.5 a	2.2 b
CONFIRM 240F[2]	240 g	11.1 a	2.8 b
CONFIRM 240F[1]	240 g	12.2 a	2.8 b
CONFIRM 240F[1]	360 g	15.5 a	2.8 b
CONTROL	-	15.5 a	28.9 a

[1] Applied 14 July (200 DD from first male moth catch), reapplied 29 July

[2] Applied 7 July (100 DD from first male moth catch), reapplied 21 July, 5 August

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 2. Percent damaged fruit per plot.

Treatment	Rate (a.i./ha)	Sample 1 25 July	Sample 2 11 Aug	First Gen. Damage 16 Sept	Second Gen. Damage 16 Sept	Total 16 Sept
DECIS 5 EC[1]	10.0 g	1.3 abc[3]	4.3 bc	3.3 a	6.0 b	9.3 b
PYRIFOS 50 WP[1]	1.7 kg	0.3 bc	2.0 c	3.3 a	2.7 c	6.0 b
ORTHENE 75 WP[1]	1.3 kg	0.3 bc	5.7 bc	4.0 a	5.3 bc	9.3 b
CONFIRM 240F[2]	240 g	0.0 c	8.3 bc	3.0 a	8.3 ab	11.3 b
CONFIRM 240F[1]	240 g	1.3 abc	11.1 ab	3.3 a	5.7 bc	9.0 b
CONFIRM 240F[1]	360 g	5.0 ab	7.7 bc	3.3 a	9.3 ab	12.7 b
CONTROL	-	6.3 a	25.3 a	8.7 a	16.7 a	25.3 a

[1] Applied 14 July (200 DD from first male moth catch), reapplied 29 July

[2] Applied 7 July (100 DD from first male moth catch), reapplied 21 July, 5 August

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

PMR REPORT # 9 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Reisling, Concord
PEST: European Red Mite, *Panonychus ulmi* (Koch)

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TITLE: CONTROL OF EUROPEAN RED MITE ON GRAPE WITH ACARICIDES

MATERIALS: CARZOL 92 SP (formetanate hydrochloride), PYRAMITE 75 WP (pyridaben)

METHODS: Two trials were conducted in mature vineyards in the Vineland, Ontario area; cv. Reisling vines were spaced 1.5 m by 2.7 m, cv. Concord vines were spaced 2.7 m by 2.7 m. Treatments were replicated three times and assigned to five-vine (Reisling) and three-vine (Concord) plots, and arranged according to a randomised complete block design. Blocks were sampled pre-treatment, and plots were sampled 5, 14, and 28 days after treatment. Samples consisted of counts made on 25 leaves per plot, picked randomly from both sides of the row. Leaves were examined using a stereomicroscope (20 leaves were brushed with a Henderson McBurnie mite brushing machine, and five leaves were examined without brushing), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) were recorded. Total numbers of beneficial mites observed were also recorded for each plot. On 18 July (Reisling) and 23 July (Concord), acaricides were diluted to a rate comparable to 2750 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 5-6 L of spray mix were used per plot; pressure was set at 2000 kPa. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in tables below. Pre-treatment samples 15 July (cv. Reisling) and 22 July (cv. Concord) showed similar numbers of ERM eggs (approximately 20 eggs per leaf) and ERM motiles (approximately 8 motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots. Beneficial mites were more numerous in the control and PYRAMITE treatments, but numbers were too low to include in the results.

CONCLUSIONS: In the 5 day sample, numbers of motiles in any of the treated plots were not significantly different from the control; similarly, numbers of eggs per leaf in the treated plots were not significantly different from the control. By 14 days after treatment, both treatments had significantly fewer motiles than the control in the cv. Reisling trial, but neither treatment was significantly different from the control in the cv. Concord trial; both treatments had significantly fewer eggs than the control in the cv. Concord trial, while only the CARZOL-treated plots had significantly fewer eggs per leaf than the control in the cv. Reisling trial. After 28 days, both treatments showed significantly fewer motiles per leaf than the control, and significantly fewer eggs per leaf than the control; these differences were observed in both trials.

Table 1. Number of ERM motiles per leaf

Treatment	Rate a.i./ha	Sample 1 - 5 days	Sample 2 - 14 days	Sample 3 - 28 days
cv. Reisling[1]				
CARZOL 92 SP	1.0 kg	11.5 a[2]	21.9 b	12.4 b
PYRAMITE 75 WP	0.225 kg	11.6 a	15.1 b	6.2 b
CONTROL	-	21.7 a	67.0 a	123.7 a
cv. Concord[3]				
CARZOL 92 SP	1.0 kg	10.9 a[2]	7.4 a	23.6 b
PYRAMITE 75 WP	0.225 kg	4.9 a	6.8 a	11.8 b
CONTROL	-	10.6 a	43.8 a	108.5 a

[1] Applied 18 July, sampled 23 July, 1 August, 15 August

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

[3] Applied 23 July, sampled 28 July, 6 August, 20 August

Table 2. Number of ERM eggs per leaf

Treatment	Rate a.i./ha	Sample 1 - 5 days	Sample 2 - 14 days	Sample 3 - 28 days
cv. Reisling[1]				
CARZOL 92 SP	1.0 kg	23.0 a[2]	15.3 b	44.1 b
PYRAMITE 75 WP	0.225 kg	26.3 a	23.6 a	34.3 b
CONTROL	-	58.4 a	80.8 a	231.1 a
cv. Concord[3]				
CARZOL 92 SP	1.0 kg	8.7 a[2]	23.9 b	26.1 b
PYRAMITE 75 WP	0.225 kg	9.4 a	13.5 b	15.9 b
CONTROL	-	26.4 a	143.4 a	151.1 a

[1] Applied 18 July, sampled 23 July, 1 August, 15 August

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

[3] Applied 23 July, sampled 28 July, 6 August, 20 August

PMR REPORT # 10 **SECTION A: INSECT PESTS OF FRUIT**

CROP: Apples *Malus sylvestris* var. Early Blaze
PEST: Oblique Banded Leafroller *Choristoneura rosaceana*

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TITLE: CONTROL OF OBLIQUE BANDED LEAFROLLER (OBLR) IN APPLES USING THREE APPLICATIONS OF SPINOSAD 480SC COMPARED TO THREE APPLICATIONS OF RIPCORD 400EC.

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), RIPCORD 400EC (cypermethrin).

METHODS: Each plot consisted of two trees in a single row and was replicated 4 times according to a randomized complete block design. Foliar application of the insecticides were made using an airblast sprayer that delivered 1000 L/ha at 300 PSI. On July 4, application one was applied which was 200 degree days (DD) after the first significant moth catch in the Niagara-on-the-Lake area of Ontario. A second application was made 7 days later (July 11). A third application was made 13 days after application one (July 17). Due to research permit requirements the rate of treatment 6 was reduced from 350 g ai/ha at application one, to 150 g ai/ha at application two, and was not applied at the third application. The rate of treatment 5 was reduced from 175 g ai/ha at application one and two, to 150 g ai/ha at the third application for the same reason. Assessments were made on July 25 and August 15. On July 25, 100 terminals were selected at random and assessed for infestation by OBLR Larvae. On August 15, 25 growing terminals (GTerm) and 25 non-growing terminals (NGTerm) were inspected from each plot and 50 fruit were inspected for fruit damage. All data were converted to percent infested terminals or percent damaged fruit. Data were analyzed using Duncan's Multiple Range Test ($p < 0.05$).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: All insecticide treatments significantly reduced the number of infested terminals and fruit damage compared to the untreated check.

Table 1. Comparisons of OBLR infested terminals and damaged fruit among SPINOSAD 480SC, RIPCORD 400EC, and an Untreated Check treatments.

Trt.	Treatment	July 25		August 15	
#	Description	% Infested Terminals	% Infested GTerm	% Infested NGTerm	% Fruit Damaged
1	Untreated Check	10.35 a	11.50 a	6.00 a	9.00 a
2	RIPCORD 250 ml prod/ha	1.55 b	3.30 b	1.00 a	1.50 b
3	SPINOSAD 87.5 g ai/ha	2.75 b	2.00 b	0.00 a	1.50 b
4	SPINOSAD 130 g ai/ha	1.75 b	5.00 b	0.00 a	2.00 b
5	SPINOSAD 175 g ai/ha	1.53 b	2.00 b	0.00 a	0.50 b
6	SPINOSAD 350 g ai/ha	1.80 b	2.30 b	2.00 a	3.00 b

* Means followed by the same letter do not significantly differ (p• 0.05).

PMR REPORT # 11

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 402-1261-9711

CROP: Nectarines, cv. Harblaze
PESTS: Western flower thrips, *Frankliniella occidentalis* (Pergrande)

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TITLE: IMIDACLOPRID FOR CONTROL OF THRIPS IN NECTARINES

MATERIALS: Imidacloprid (ADMIRE), 21.8% flowable

METHODS: The trial was conducted in a 0.4 ha block of nectarines, cv. Harblaze, planted in 1991 and trained as open centre trees. The entire block received a dormant oil treatment on April 22 and a pirimicarb (PIRIMOR 50 WP) application on May 22.

The experimental design was a randomized complete block with four replicates, and four trees per treatment. Data was collected from the two centre trees. Treatments were applied on May 8 and 12, approximately five and nine days after full bloom. The treatments were applied with a commercial sprayer equipped with a hand-gun at a pressure of approximately 700 kPa. On both dates, application was made in late afternoon under calm wind conditions (0-4 kph) and temperatures of 22• (May 8) and 24• (May 12). The volume of liquid used per tree was approximately 3 L.

Fruit for insect damage assessment were collected on June 16. The fruit were graded into three categories; clean: no blemishes, scars, fruit deformation or bumps; slight damage: no major scars or fruit deformation, but some minor blemishes and/or bumps (as fruit increase in size, most of these will disappear or be masked by coloration and may be marketable); cull: clearly non-marketable because of insect damage.

To determine that the target insect was Western flower thrips, the trees were monitored very closely before and after treatment for the presence of other insects. No significant amounts of any other insect pests were discovered until May 26 when a light infestation of green peach aphid was discovered and controlled with pirimicarb.

RESULTS: Results of the damage assessment are presented in Table 1. All three insecticides used at the first date of application significantly increased the clean fruit but, only imidacloprid significantly decreased the culls. At the second date of application, only endosulfan (THIODAN 50 WP)significantly increased the clean fruit and reduced the culls.

CONCLUSION: From the data collected it appears that approximately 85% of the untreated nectarine fruit were affected by the Western flower thrips in 1997. Assuming a high rate of efficacy of imidacloprid against this insect based on greenhouse/laboratory trials (unpublished data), approximately 35% of the flowers/fruitlets would have been visited and affected by the thrips before the first date of application. Thrips counts following limb taps from just before full bloom until first date of application confirmed that thrips were present at 1-5 thrips per limb. Along with the data collected in 1996 (Pest Management Res. Rept. 1996:256-257), this would indicate that for improved efficacy, the application of imidacloprid should be carried out earlier.

Table 1. Thrips damage to nectarines following the application of three insecticides at two dates.

Treatment	Rate (g a.i./100L)	5 DAFB[1](% of total)		9 DAFB (% of total)	
		Clean	Cull	Clean	Cull
Check	-	14.1 b[2]	53.4 b	17.5 b	55.5 a
Imidacloprid	10.0	47.7 a	29.5 a	32.0 ab	37.3 ab
Pirimicarb	25.0	36.5 a	41.2 ab	22.6 ab	49.2 ab
Endosulfan	37.5	31.0 a	40.7 ab	33.0 a	33.9 b

[1] DAFB = days after full bloom

[2] Means within columns followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test).

PMR REPORT # 12 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Vivid
PEST: European Red Mite, *Panonychus ulmi* (Koch)

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TITLE: CONTROL OF EUROPEAN RED MITE ON PEACH WITH VARIOUS ACARICIDES

MATERIALS: KELTHANE AP-35 (dicofol), CARZOL 92 SP (formetanate hydrochloride), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan Station, Ontario, area; trees cv. Vivid were spaced 5.4 m by 6.0 m. Treatments were replicated three times and assigned to two-tree plots separated by guard trees, and arranged according to a randomised complete block design. Previous laboratory studies had determined that this population was susceptible to KELTHANE. Plots were sampled pre-treatment 5 August, and three times post-treatment, 12 August, 22 August, and 4 September. Efficacy ratings were conducted at 5, 15, and 28 days after treatment, and consisted of counts made on 50 leaves per plot, picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope (45 leaves were brushed with a Henderson McBurnie mite brushing machine, and five leaves were examined without brushing), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) were recorded. Total numbers of beneficial mites observed were also recorded for each plot. On 7 August, acaricides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in tables below. Prespray samples 5 August showed similar numbers of ERM eggs (approximately 30 eggs per leaf) and ERM motiles (approximately 10 motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots. Beneficial mites were more numerous in the control and PYRAMITE treatments, but numbers were too low to include in the results.

CONCLUSIONS: In the 5 day sample, numbers of motiles in any of the treated plots were not significantly different from the control, while the KELTHANE and PYRAMITE treatments had significantly fewer eggs per leaf. By 15 days after treatment, all treatments had significantly fewer motiles than the control, with numbers on PYRAMITE-treated plots significantly lower than in CARZOL-treated plots; all three treatments had significantly fewer eggs per leaf than the control. After 28 days, all treatments showed significantly fewer motiles than the control, with KELTHANE significantly lower than CARZOL, and PYRAMITE significantly lower than both CARZOL and KELTHANE. Between 15 and 28 days after treatment, the numbers of motiles in the control and CARZOL-treated plots had approximately doubled, but the increases were not statistically significant. The CARZOL treatment showed no significant reduction in number of eggs after 28 days, while PYRAMITE and KELTHANE were both significantly lower than the control. The PYRAMITE treatment had significantly fewer eggs per leaf than both the CARZOL and KELTHANE treatments.

Table 1. Number of ERM motiles per leaf

Treatment[1]	Rate a.i./ha	Sample 1 5 days	Sample 2 15 days	Sample 3 28 days
CARZOL 92 SP	1.0 kg	20.6 a[2]	23.6 b	47.1 b
KELTHANE AP 35	1.6 kg	10.9 a	7.5 bc	10.0 c
PYRAMITE 75 WP	0.225 kg	10.0 a	4.3 c	3.6 d
CONTROL	-	48.6 a	95.9 a	181.0 a

[1] Applied 7 August

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Number of ERM eggs per leaf

Treatment[1]	Rate a.i./ha	Sample 1 5 days	Sample 2 15 days	Sample 3 28 days
CARZOL 92 SP	1.0 kg	152.2 a[2]	47.2 b	64.2 a
KELTHANE AP 35	1.6 kg	85.2 b	58.2 b	47.3 b
PYRAMITE 75 WP	0.225 kg	95.5 b	39.7 b	12.7 c
CONTROL	-	337.7 a	191.1 a	93.3 a

[1] Applied 7 August

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

PMR REPORT # 13 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF ORIENTAL FRUIT MOTH ON PEACH WITH VARIOUS INSECTICIDES

MATERIALS: DECIS 5 EC (deltamethrin), DIAZINON 50 WP (diazinon), LORSBAN 50 WP (chlorpyrifos), ORTHENE 75 WP (acephate), PYRIFOS 50 WP (chlorpyrifos)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 5.4 m by 6.0 m. Treatments were replicated three times and assigned to two-tree plots separated by guard trees, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. Treatments were applied at egg hatch; 10 June for the first generation, and twice for the second generation, 10 July and 24 July. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 7-8 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled post-treatment, 24 June and 31 July; all infested terminals and fruit were removed, and examined for the presence of live larvae. Efficacy ratings were expressed as total damage, consisting of the total number of infested terminals and peaches. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in table 1 below. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the sample taken 24 June to assess the effects of treatments on the first generation, only the plots treated with DECIS or DIAZINON showed significantly less damage than the control. In the 31 July (second generation) sample, the DECIS-treated plots showed significantly less damage than the control, while damage in the other plots was not significantly lower than the control. Infestations were considered heavy.

Table 1. Total OFM damage per plot[1]

Treatment[2]	Rate (a.i./ha)	Generation 1 24 June	Generation 2 31 July
DECIS 5EC	10 g	2.0 b[3]	19.7 b
DIAZINON 50 WP	1.7 kg	2.3 b	42.7 a
LORSBAN 50 WP	1.7 kg	6.3 a	46.3 a
PYRIFOS 50 WP	1.7 kg	7.0 a	25.0 a
ORTHENE 75 WP	1.3 kg	11.7 a	45.0 a
CONTROL	-	10.7 a	82.7 a

[1] Total Damage = # infested terminals + # damaged fruit

[2] Applied 10 June, 10 July, 24 July

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

PMR REPORT #14

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST ORIENTAL FRUIT MOTH ON PEACH

MATERIALS: DECIS 5 EC (deltamethrin), COMPLY 40 WP (Fenoxycarb), RH2485 80 WP

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 5.4 m by 6.0 m. Treatments were replicated three times and assigned to two-tree plots separated by guard trees, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. DECIS and RH2485 treatments were applied at egg hatch; 10 June for the first generation, and twice for the second generation, 10 July and 24 July. Latron B-1956 (0.012%) was added to the RH2485 treatments as a spreader/sticker. The COMPLY treatment was applied before egg hatch; 5 June for the first generation, and twice for the second generation, 8 July and 22 July. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 7-8 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled post-treatment, 24 June and 31 July; all infested terminals and fruit were removed, and examined for the presence of live larvae. Efficacy ratings were expressed as total damage, consisting of the total number of infested terminals and peaches. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in table 1 below. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the samples taken 24 June to assess the effects of treatments on the first generation, only the plots treated with DECIS showed significantly less damage than the control. Similarly, in the 31 July (second generation) sample, only the plots treated with DECIS showed significantly less damage than the control. Infestations were considered heavy.

Table 1. Total OFM damage per plot[1]

Treatment	Rate (a.i./ha)	Generation 1 24 june	Generation 2 31 july
DECIS 5EC[2]	10 g	1.3 b[5]	17.7 b
COMPLY 40 WP[3]	277 g	12.7 a	59.3 a
RH2485 80 WP[2,4]	240 g	13.3 a	71.7 a
RH2485 80 WP[2,4]	360 g	11.0 a	54.0 ab
CONTROL	-	10.7 a	66.0 a

[1] Total Damage = # infested terminals + # damaged fruit

[2] Applied 10 June, 10 July, 24 July

[3] Applied 5 June, 8 July, 22 July

[4] Latron B-1956 (0.012%) added as a sticker-spreader.

[5] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

RLD RAPPORT # 15 **SECTION A: INSECTES DES FRUITS**
IRAC # : 93000234

CULTURE : Pommier
RAVAGEUR : Charançon de la prune, *Conotrachelus nenuphar* Herbst.

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TITRE: PIÈGE DE TEDDER APPÂTÉ POUR LE DÉPISTAGE DU CHARANÇON DE LA PRUNE EN VERGERS DE POMMIERS

PRODUITS: Piège de Tedder, acide grandisoïque, GLV.

MÉTHODES: Différents essais ont eu lieu dans 8 vergers, à la saison 1997, en vue d'améliorer l'efficacité du piège de Tedder. À l'intérieur de chaque verger, cinq secteurs ont été définis (nord, sud, est, ouest et centre) avec une série complète de traitements par secteur. Trois paramètres ont été testés avec pour base le piège de Tedder surmonté d'une pièce collectrice. Trois doses (0, 5 et 10 mg) d'acide grandisoique (AC), phéromone d'agrégation du charançon de la prune, ont été comparées dans 3 vergers. De même, 3 doses (0, 5 et 200 mg) de composés volatiles végétaux (general green leaf volatiles ou GLV) ont été utilisés comme additif à la phéromone pour en augmenter l'efficacité d'attraction dans deux vergers. Enfin, deux localisations des sources d'odeur sur le piège, soit à 15 cm et 125 cm de hauteur, ont été testées dans 3 autres vergers. Les sources d'odeur ainsi que les capsules de phéromones ont été posées, dès réception de l'AC fraîchement synthétisée, le 3 juin. Le relevé des captures a été effectué deux fois par semaine de la floraison (6 juin) à la mi juillet.

RÉSULTATS: Voir tableaux ci-dessous

CONCLUSIONS: Le piège de Tedder représentait en lui-même une méthode relativement fiable de dépistage des premiers adultes. Malgré le retard dans la pose des attractifs, les résultats de cette année permettent de mettre en évidence l'effet d'attraction de la phéromone en vergers. D'autre part, les GLV à 5 mg ont un effet attractif lorsqu'utilisés en combinaison avec l'AC. Le piège de Tedder, muni d'une capsule de phéromone et d'un GLV à déterminer à 15 cm du sol, apparaît comme une avenue intéressante pour le dépistage de l'insecte. Les études se poursuivront en 1998-99.

Tableau 1. Effet de trois paramètres sur l'efficacité du piège de Tedder pour la capture du charançon de la prune en vergers de pommiers

	Dose AC (mg)[1]			Hauteur (cm)		Dose GLV (mg)		
	0	5	10	15	125	0	5	200
Captures[2]	0,27	0,73	0,67	2,5	1,67	5,8	7,4*	3,7*
Nbre pièges	15	15	15	15	15	10	40	40

[1] Les trois essais ont eu lieu dans différents vergers

[2] moyenne par piège des captures de toute la saison

[3] différence significative à $p=0,05$

RLD RAPPORT # 16 **SECTION A:INSECTES DES FRUITS**

IRAC # :94000464

CULTURE: Pommier
RAVAGEUR: Tétranyque rouge

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TITRE: **ÉVALUATION DU POTENTIEL DE PRÉDATION DE LA PUNAISE TRANSLUCIDE POUR LA RÉPRESSION DU TÉTRANYQUE ROUGE EN VERGERS DE POMMIERS**

MÉTHODES: Dans un verger commercial, on a introduit 800 prédateurs du genre *Hyaliodes* à raison de 100 insectes par arbre sur 8 arbres. Huit autres pommiers ont servi de témoins négatifs. Le suivi des populations de tétranyques a été mené de la veille de l'introduction à deux semaines après. Pour ce faire, des dénombrements ont été réalisés 2 fois par semaine sur les 8 arbres; les tétranyques (œufs et formes mobiles) ont été dénombrés sur 10 feuilles par arbre, de même que l'intensité de colonisation par les pucerons sur 5 pousses par arbre et le nombre de punaises observées en trois minutes par arbre.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSION: La punaise translucide a permis la régression des populations totales de tétranyques là où elle a été introduite. D'autre part, dans le cadre du même projet de recherche, on a établi qu'elle peut se maintenir plus d'un an après son introduction dans un verger. Cette punaise apparaît comme un outil naturel de répression de ravageurs à protéger par une régie adaptée.

Tableau 1: Évolution des populations totales de tétranyques avec ou sans introduction de punaise translucide.

Date	Nombre moyen d'œufs et de formes mobiles de tétranyques/feuille			
	Pommiers avec *Hyaliodes*		Témoins	
	Nbre total	écart-type	Nbre total	écart-type
16-juil	3.15	1.52	4.18	1.24
18-juil	4.70	1.69	6.30	1.93
21-juil	3.42	1.17	4.15	1.58
24-juil	3.49	1.28	7.94	3.18
28-juil	4.99	1.98	8.40	2.50
31-juil	4.54	1.60	11.31	3.73
04-août	3.75	1.43	10.36	3.48

PMR REPORT # 17 **SECTION A: INSECT PESTS OF BERRY CROPS**
STUDY DATA BASE: 306-1262-9020

CROP: Lowbush blueberry
PEST: Blueberry maggot adult (BM), *Rhagoletis mendax* Curran(L.).

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TITLE: EFFICACY OF SLOW RELEASE BAITED PHEROCON TRAPS COMPARED WITH CONVENTIONAL BAITED PHEROCON TRAP

MATERIALS: Pherocon traps baited with slow release (SR) formulation baits: type 1 (ammonium salt) and type 2 (blueberry volatile); conventional baited Pherocon traps.

METHODS: The experiment was conducted on 5 commercial lowbush blueberry fields (4-10 ha each) in Colchester and Cumberland Co. N.S. Traps (16) were paired by site location and placed 6 m apart at each location within each field in a factorial design with SR trap type as a split plot. Adult *R. mendax* captures were monitored three times weekly from June 27 to August 14, 1997. The Pherocon traps (but not the SR baits) were replaced after 3 weeks. A comparison of mean captures on each type of trap was conducted using ANOVA. Counts per trap type were analyzed to determine the relative efficacy of the traps for both male and female *R. mendax* in vegetative and fruiting fields.

RESULTS: No difference ($p<0.05$) was found in captures between trap types for either vegetative or fruiting fields.

CONCLUSIONS: The conventional baited Pherocon trap and the slow release baited Pherocon traps were equally effective in capturing adult *R. mendax* in commercial lowbush blueberry fields.

Table 1. Mean adult *R. mendax* captures (sem) on 40 sets of paired traps set in commercial lowbush blueberry fields in Nova Scotia.

Treatment	*R. mendax* adult captures	
	Males	Females
	(#)	
Conventional baited Pherocon trap	2.9 (0.41)	6.7 (1.17)
SR baited Pherocon trap type 1	2.2 (0.58)	3.8 (1.65)
SR baited Pherocon trap type 2	2.6 (0.58)	7.9 (1.65)

PMR REPORT # 18 **SECTION A: INSECT PESTS OF BERRY CROPS**
STUDY DATABASE: 87000180

CROP: Choke cherry, *Prunus virginiana* var. *melanocarpa* (A. Nels.) Sarg.
PEST: Thrips, *Thrips vulgatissimus* Haliday

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TITLE: EVALUATION OF PRODUCTS FOR CONTROL OF THRIPS ON CHOKE CHERRY AT TWO SITES IN SASKATCHEWAN, IN 1997

MATERIALS: DECIS 5EC (deltamenthrin 5% EC), MALATHION 50EC (malathion 50% EC).

METHODS: In the spring of 1997, thrips were observed feeding on the flowers of choke cherry. Two insecticides and a water check were evaluated at two sites for the control of this potential pest. Site #1 was at the PFRA Shelterbelt Centre (SW11-18-13-W2) near Indian Head, Saskatchewan. Site #2 was near Lake Katepwa (SW28-19-12-W2) in the Qu'Appelle Valley. At Site #1, treatments were replicated four times within a 12-year-old single-row choke cherry shelterbelt. Plants within the row were spaced at 1 m. Plots were 8 m long with a 2 m buffer between plots. At Site #2 the trial was replicated five times along the edge of a natural stand of choke cherry. Plots were 10 m long with a 2 m buffer between plots. The trials were set up in a Randomized Complete Block design.

Treatments were applied on May 16, 1997 with a portable high pressure sprayer at 480 kPa at a rate of 22 to 24 L per 100 m^2 of plant surface area. At the time of application the trees were 95% leafed and the flower clusters were in the green tip stage with pedicels not yet extended. The majority of choke cherry flowering occurred June 2 to 6.

Assessment of thrip populations were made on May 20 (4 days after treatment). Thrip populations were estimated by collecting 40 flower clusters from each plot. At Site #1, 20 flower clusters were collected from each side of the shelterbelt. Each flower cluster was placed into a ziploc® bag and then shaken vigorously to dislodge the thrips. The number of thrips observed moving inside each bag was recorded. Plant phytotoxicity assessments were made on June 11.

Mature fruit was collected to determine if insecticide application had an impact on fruit set. One hundred fruit clusters were collected from each plot and the number of berries per cluster recorded. These assessments were done August 11 to 18 at Site #2 and from August 19 to 22 at Site #1. Two replications at Site #2 were not used in this analysis since the minimum 100 clusters could not be found. Two-way ANOVA was conducted with means separated by the Duncan's Multiple Range Test. Fruit was collected for future insecticide residue analysis.

RESULTS: No phytotoxic damage was noted on choke cherries treated with DECIS or MALATHION. Both DECIS and MALATHION significantly reduced thrip populations on choke cherry flowers when applied as a foliar spray approximately 19 days before full flowering (Table 1). Fruit set was not significantly affected by the application of insecticide at either site.

CONCLUSIONS: DECIS and MALATHION were not phytotoxic to choke cherry. DECIS and MALATHION significantly reduced the populations of thrips on choke cherry flowers. Thrip populations at the level observed in 1997, did not affect fruit set.

Table 1. The number of thrips per flower cluster and the number of berries per cluster recorded in plots treated with DECIS and MALATHION at two sites in Saskatchewan in 1997.

	Rate of product		Thrips/flower cluster		Berries/cluster	
Treatment	L/ha	L/1000 L	I.H.*	L.K.	I.H.	L.K.**
DECIS 5EC	0.200	0.092	0.01 b***	0.00 b	9.0 a	4.8 a
MALATHION 50 EC	6.024	2.500	0.03 b	0.01 b	7.6 a	4.8 a
Water check	-	-	1.26 a	0.48 a	7.2 a	3.6 a

* I.H. = Indian Head and L.K. = Lake Katepwa.

** Berries/cluster values from Lake Katepwa based on three replications of each treatment.

*** Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

PMR REPORT # 19

SECTION A: INSECT PESTS OF BERRY CROPS
STUDY DATABASE: 87000180

CROP: Choke cherry, *Prunus virginiana* var. *melanocarpa* (A. Nels.) Sarg.
PEST: Prairie tent caterpillar, *Malacosoma californicum lutescens* (Neumoegen & Dyar) and ugly nest caterpillar, *Archips cerasivorana* (Fitch).

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TITLE: EVALUATION OF PRODUCTS FOR CONTROL OF PRAIRIE TENT CATERPILLAR AND UGLY NEST CATERPILLAR ON CHOKE CHERRY AT TWO SITES IN SASKATCHEWAN, IN 1997.

MATERIALS: DECIS 5 EC (deltamenthrin 5% EC), DIPEL DF (*Bacillus thuringiensis* subsp. *kurstaki* 32,000 IU/mg), D.Z.N. 600 EW (diazinon 56% EW), MALATHION 50 EC (malathion 50% EC).

METHODS: The prairie tent caterpillar (PTC) and ugly nest caterpillar (UNC) are common tent-forming defoliators of choke cherry on the Prairies. Four insecticides and a water check were evaluated for control of these insects at two sites. Both sites were single row field shelterbelts located near Indian Head, Saskatchewan and composed of species in the following design: three choke cherry, one green ash, three caragana and one green ash. All plants were at a 0.75 m spacing within the row. Site #1 was at the Lyle Alspach farm (NW12-18-13-W2) where the choke cherry plants were five-years-old and each treatment plot consisted of three groups of three choke cherries for a total of nine plants. Site #2 was at the D'Arcy Gares farm (NE9-18-13-W2) where the plants were six-years-old and each treatment plot consisted of two groups of three choke cherries for a total of six plants. The trials were set up in a Randomized Complete Block design with five replications at site #1 and four replications at site #2.

Treatments were applied on May 27, 1997 with a portable high pressure sprayer at 480 kPa at a rate of 22 L of solution per 100 m^2 of plant surface area. Plants were sprayed until the foliage was wet but not dripping. PTC tents were visible on May 27 but there was no evidence of UNC tents. Choke cherry plants were fully leafed by May 27 and the flower clusters were in the green tip stage with pedicels fully extended. The majority of choke cherry flowering occurred June 2 to 6.

Plant phytotoxicity assessments were taken June 2 to 4 and June 17 to 20. Assessment of PTC larval populations occurred on June 2 to 4 (6 to 8 days after treatment) while UNC larval populations were assessed June 17 to 20 (21 to 24 days after treatment). Assessments were made by removing all PTC and UNC tents from each choke cherry in the plot and counting the number of live larvae per tent. A two-way ANOVA was conducted with the means separated by the Duncan's Multiple Range Test. Berry samples were not taken for residue testing since not enough fruit was produced on these relatively young plants.

RESULTS: No phytotoxic damage was noted for choke cherries treated with DECIS, DIPEL, D.Z.N. or MALATHION. As expected, PTC tents that were present at the time of application (May 27) were still present on the first assessment date (June 2 to 4), therefore there was no significant difference in the number of PTC tents per plant (Table 1). At both sites, all insecticide treatments significantly reduced the number of live PTC larvae per plant when compared to the water check. There was no significant difference between insecticide treatments in their effectiveness in reducing FTC larval populations. The FTC larval population at Alspach's was almost three times higher than at Gares'. No UNC tents were visible on June 2 to 4.

On the UNC assessment date (June 17 to 21), the number of UNC tents per plant was significantly lower in the insecticide treated plots when compared to the check (Table 2). The UNC larvae were probably just starting to emerge at the time of treatment (May 27) and the insecticides controlled the UNC larvae before they were able to construct a tent. All insecticide treatments significantly reduced the number of live UNC larvae per plant when compared to the check. There was no significant difference between insecticide treatments in their effectiveness in reducing UNC larval populations. The UNC larval population at Gares' was almost ten times higher than at Alspach's.

CONCLUSIONS: DECIS, DIPEL, D.Z.N. or MALATHION applied as a foiiar spray to choke cherry just before flowering effectively controlled both the PTC and the UNC before these insects caused significant plant damage.

Table 1. Number of prairie tent caterpillar tents and larvae per plant recorded on choke cherry six to eight days after treatment with insecticide at two sites in Saskatchewan in 1997.

	Rate of product		Alspach farm		Gares farm	
Treatment	/ha	/1000L	Tents/ plant	Larvae/ plant	Tents/ plant	Larvae/ plant
DECIS 5EC	0.200 L	0.092 L	0.62 a*	0.0 b	0.67 a	0.0 b
DIPEL DF	1.720 kg	0.792 kg	0.56 a	7.4 b	0.50 a	0.0 b
D.Z.N. 600EW	1.688 L	0.777 L	0.69 a	0.0 b	0.46 a	0.0 b
MALATHION 50 EC	5.414 L	2.500 L	0.53 a	0.0 b	0.54 a	0.0 b
Water check	-	-	0.73 a	126.5 a	0.42 a	45.8 a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

Table 2. Number of ugly nest caterpillar tents and larvae per plant recorded on choke cherry 21 to 24 days after treatment with insecticide at two sites in Saskatchewan in 1997.

	Rate of product		Alspach farm		Gares farm	
Treatment	/ha	/1000L	Tents/ plant	Larvae/ plant	Tents/ plant	larvae/ plant
DECIS 5EC	0.200 L	0.092 L	0.00 b*	0.0 b	0.00 b	0.0 b
DIPEL DF	1.720 kg	0.792 kg	0.00 b	0.0 b	0.04 b	0.0 b
D.Z.N. 600EW	1.688 L	0.777 L	0.02 b	1.3 b	0.04 b	1.4 b
MALATHION 50 EC	5.414 L	2.500 L	0.07 b	2.7 b	0.29 b	11.8 b
WATER	-	-	0.31 a	16.9 a	1.54 a	161.9 a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

PMR REPORT # 20 **SECTION A: INSECT PESTS OF BERRY CROPS**
STUDY DATABASE: 87000180

CROP: Choke cherry, *Prunus virginiana* var. *melanocarpa* (A. Nels.) Sarg.
PEST: Choke cherry aphid, *Rhopalosiphum cerasifoliae* (Fitch)
Choke cherry midge, *Contarinia virginianae* Felt.

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TITLE: EVALUATION OF PRODUCTS FOR CONTROL OF CHOKE CHERRY APHID AND CHOKE CHERRY MIDGE ON CHOKE CHERRY IN SASKATCHEWAN, IN 1997.

MATERIALS: DECIS 5 EC (deltamenthrin 5% EC), D.Z.N. 600 EW (diazinon 56% EW), MALATHION 50 EC (malathion 50% EC).

METHODS: Three insecticides and a water applied control were evaluated for control of the choke cherry aphid (CCA)and choke cherry midge (CCM). The CCA feeds of the foliage causing the leaves to curl. The CCM causes the berries to form a pear-shaped gall. The trial was conducted on a 12-year-old choke cherry shelterbelt located on the PFRA Shelterbelt Centre, Indian Head, Saskatchewan (SW11-18-13-W2). The choke cherry were a seedling source. Plots were 8 m long with 2 m buffers between plots. Treatments were replicated four times in a Randomized Complete Block design.

Treatments were applied on June 11,1997 with a portable high pressure sprayer at 480 kPa at a rate of 22 L per 100 m^2 of plant surface area. At the time of application the plants had just completed petal drop and small fruit was just starting to form. The majority of choke cherry flowering occurred from June 2 to 6.

Assessment of CCA populations was conducted on June 13 (2 days after treatment). Five leaves showing leaf-curl damage were randomly collected from each plot. The number of live aphids per leaf was determined using a binocular microscope. CCM populations were assessed on June 25 and 26 (14 to 15 days after treatment) by randomly collecting 20 fruit clusters per plot (10 from the east side and 10 from the west side) and recording the number of CCM infested berries and the number of healthy berries per cluster. Phytotoxicity ratings were taken on June 27.

Mature fruit was collected to determine if insecticide application had an impact on fruit set. One hundred fruit clusters were collected from each plot and the number of healthy berries per cluster recorded. These assessments were done from August 19 to 22 (69 to 72 days after treatment). Two-way ANOVA was conducted with means separated by the Duncan's Multiple Range Test. Fruit was collected from each plot for future insecticide residue analysis.

RESULTS: No phytotoxicity was noted. CCA populations were significantly lower in the insecticide treated plots compared to the check (Table 1). The most effective insecticide for control of the CCA was MALATHION followed by DECIS and D.Z.N. Insecticide treatment did not have a significant impact on CCM populations. The relatively high incidence of CCM galls in the DECIS treatment was caused by a high gall count on one tree on the east side of one DECIS plot. The reason for this variability is unknown. Insecticide application did not significantly affect the number of healthy fruit produced per cluster on either assessment date. Plant to plant variability in fruit set and CCM susceptability may have masked treatment differences.

CONCLUSIONS: DECIS, D.Z.N. and MALATHION effectively reduced CCA populations within 2 days of application. The incidence of CCM galls was not reduced by insecticide application nor was fruit set improved by insecticide application. Earlier application dates should be tested for CCM control since we suspect that the berries had already been infested by the CCM before treatments were applied in 1997.

Table 1. Evaluation of products for control of choke cherry aphid and choke cherry midge at Indian Head, Saskatchewan in 1997.

	Rate of product		Live aphids/ leaf curl	Midge galls/ cluster	Healthy berries/cluster	
Treatment	L/ha	L/1000L	June 13	June 25	June 25	Aug 19
DECIS 5EC	0.200	0.092	5.9 c*	0.9 a	10.3 a	7.2 a
D.Z.N. 600EW	1.688	0.777	11.8 b	0.2 a	10.1 a	7.8 a
MALATHION 50EC	5.414	2.500	0.3 d	0.3 a	12.0 a	8.1 a
Water check	-	-	152.0 a	0.2 a	9.2 a	5.6 a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

PMR REPORT # 21 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Reisling, Concord
PEST: European Red Mite, *Panonychus ulmi* (Koch)

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TITLE: CONTROL OF EUROPEAN RED MITE ON GRAPE WITH ACARICIDES

MATERIALS: CARZOL 92 SP (formetanate hydrochloride), PYRAMITE 75 WP (pyridaben)

METHODS: Two trials were conducted in mature vineyards in the Vineland, Ontario area; cv. Reisling vines were spaced 1.5 m by 2.7 m, cv. Concord vines were spaced 2.7 m by 2.7 m. Treatments were replicated three times and assigned to five-vine (Reisling) and three-vine (Concord) plots, and arranged according to a randomised complete block design. Blocks were sampled pre-treatment, and plots were sampled 5, 14, and 28 days after treatment. Samples consisted of counts made on 25 leaves per plot, picked randomly from both sides of the row. Leaves were examined using a stereomicroscope (20 leaves were brushed with a Henderson McBurnie mite brushing machine, and five leaves were examined without brushing), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) were recorded. Total numbers of beneficial mites observed were also recorded for each plot. On 18 July (Reisling) and 23 July (Concord), acaricides were diluted to a rate comparable to 2750 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 5-6 L of spray mix were used per plot; pressure was set at 2000 kPa. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in tables below. Pre-treatment samples 15 July (cv. Reisling) and 22 July (cv. Concord) showed similar numbers of ERM eggs (approximately 20 eggs per leaf) and ERM motiles (approximately 8 motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots. Beneficial mites were more numerous in the control and PYRAMITE treatments, but numbers were too low to include in the results.

CONCLUSIONS: In the 5 day sample, numbers of motiles in any of the treated plots were not significantly different from the control; similarly, numbers of eggs per leaf in the treated plots were not significantly different from the control. By 14 days after treatment, both treatments had significantly fewer motiles than the control in the cv. Reisling trial, but neither treatment was significantly different from the control in the cv. Concord trial; both treatments had significantly fewer eggs than the control in the cv. Concord trial, while only the CARZOL-treated plots had significantly fewer eggs per leaf than the control in the cv. Reisling trial. After 28 days, both treatments showed significantly fewer motiles per leaf than the control, and significantly fewer eggs per leaf than the control; these differences were observed in both trials.

Table 1. Number of ERM motiles per leaf

Treatment	Rate a.i./ha	Sample 1 5 days	Sample 2 14 days	Sample 3 28 days
cv. Reisling[1]				
CARZOL 92 SP	1.0 kg	11.5 a[2]	21.9 b	12.4 b
PYRAMITE 75 WP	0.225 kg	11.6 a	15.1 b	6.2 b
CONTROL	-	21.7 a	67.0 a	123.7 a
cv. Concord[3]				
CARZOL 92 SP	1.0 kg	10.9 a[2]	7.4 a	23.6 b
PYRAMITE 75 WP	0.225 kg	4.9 a	6.8 a	11.8 b
CONTROL	-	10.6 a	43.8 a	108.5 a

[1] Applied 18 July, sampled 23 July, 1 August, 15 August

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

[3] Applied 23 July, sampled 28 July, 6 August, 20 August

Table 2. Number of ERM eggs per leaf

Treatment	Rate a.i./ha	Sample 1 5 days	Sample 2 14 days	Sample 3 28 days
cv. Reisling[1]				
CARZOL 92 SP	1.0 kg	23.0 a[2]	15.3 b	44.1 b
PYRAMITE 75 WP	0.225 kg	26.3 a	23.6 a	34.3 b
CONTROL	-	58.4 a	80.8 a	231.1 a
cv. Concord[3]				
CARZOL 92 SP	1.0 kg	8.7 a[2]	23.9 b	26.1 b
PYRAMITE 75 WP	0.225 kg	9.4 a	13.5 b	15.9 b
CONTROL	-	26.4 a	143.4 a	151.1 a

[1] Applied 18 July, sampled 23 July, 1 August, 15 August

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

[3] Applied 23 July, sampled 28 July, 6 August, 20 August

STUDY DATABASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Honeywood, Smoky, Thiessen
PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: EVALUATION OF ADMIRE AND ORTHENE FOR CONTROL OF WOOLLY ELM APHID ON ROOTS OF FRUIT-BEARING SASKATOON BERRY PLANTS AT THREE SITES IN SASKATCHEWAN.

MATERIALS: ADMIRE 24FL (imidacloprid 24 FL), ORTHENE 75WP (acephate 75 WP)

METHODS: The woolly elm aphid (WEA) attacks the roots of saskatoon plants causing the decline and death of seedlings during establishment years. Minor use registration has been approved for the use of ORTHENE for control of WEA on non-fruit bearing saskatoon seedlings. In this trial, ORTHENE and ADMIRE were applied to 4-year old saskatoon plants to determine if the products would: 1) control WEA on fruit-bearing plants, 2) increase fruit yields, and 3) not cause residues in the fruit.

ADMIRE and ORTHENE were applied by soil probe injection to the roots of saskatoon plants at D'Arcy (Site 1), Marquis (Site 2) and Moosomin (Site 3), Saskatchewan after fruit harvest was complete. ADMIRE was applied at a rate of 0.125 ml product/plant and ORTHENE at 1.7 g product/plant. A WATER CHECK treatment was also applied at each site. Each site was a U-Pick orchard with rows spaced 3 m apart and an in-row spacing of 1 m. At Site 1, the treatments were applied on August 1, 1996 to 4-year old "Honeywood". At Site 2, treatments were applied on July 31, 1996 to 4-year old "Thiessen". At Site 3, treatments were applied on August 1, 1996 to 4-year old "Smoky". The soil at all three sites was a clay loam. The three treatments were replicated three times at each site in a Randomized Complete Block design with each plot consisting of three plants. A single plant was left untreated between plots to act as a buffer.

Treatments were applied using a soil probe injector. The apparatus consisted of a CO_2 pressurized backpack sprayer (R&D Sprayer Inc., Model D-201S) equipped with a modified handgun that had a shop built soil probe instead of a spray nozzle. The probe was constructed of a 10 mm diameter hollow metal pipe with a pointed end and a slit cut along one side of the pipe about 2 cm from the tip. At 250 kPa, about 2 L/min of fluid flowed through the slit in a 90 degree fan pattern. The probe was pushed into the soil to a depth of about 12 cm, with 6 to 8 probes made around each plant at a distance of about 25 cm from the main stem. Two litres of solution was delivered to each plant using the soil probe injector.

Evaluation for aphid infestations on the roots was conducted on August 22, 26 and 29, 1996 at Sites 2, 1 and 3, respectively. Root infestation measurements were taken by examining half the roots of each plant. A 20 cm deep trench was dug in a semicircle approximately 50 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only roots within a 25 cm radius of the main shoots were assessed. The length of aphid infested root was measured and recorded.

Fruit yield was assessed by hand harvesting the berries and recording the weight of all the fruit within each plot. Harvest was conducted at Site 1 on July 21 and 22, 1997, and at Site 2 and 3 on July 24, 1997. The fruit was placed in freezer storage for residue analysis at a later date.

A two-way ANOVA was conducted on the length of WEA infested root and fruit yield, with means separated by the Duncan's Multiple Range Test. A square root (x+1) transformation was conducted on infestation ratings before ANOVA.

RESULTS: Insecticide treatment did not significantly reduce the amount of WEA infested root at the Marquis and Moosomin sites. ADMIRE and ORTHENE did reduce the amount of WEA infested root at the D'Arcy site. ORTHENE was more effective than ADMIRE at the D'Arcy site. Insecticide treatment did not significantly increase fruit yield at two of three sites. At the third site, fruit yield analysis was not conducted since only two replications were harvested at this site. Residue analysis has not yet been completed.

CONCLUSIONS: ADMIRE and ORTHENE at two litres of solution per plant did not provide satisfactory control of WEA infestations on the roots of 4-year old plants at two of three sites. We suspect that the poor control was caused by poor coverage in the root zone since only 2 L of solution was used on these relatively large plants. Further tests should be conducted with increased amounts of solution per plant and/or increased rates of product per plant.

Table 1. Impact of ADMIRE and ORTHENE applied to saskatoon roots on infestation by woolly elm aphid and on fruit yield 11 months after treatment at three locations in Saskatchewan.

	D'Arcy		Marquis		Moosomin	
	Infestation* (cm)	Yield (kg)	Infestation (cm)	Yield (kg)**	Infestation (cm)	Yield (kg)
ADMIRE	27.7 b***	1.48 a	5.8 a	0.54	17.2 a	0.88 a
ORTHENE	4.9 c	2.21 a	2.4 a	0.55	16.1 a	0.98 a
Check	67.9 a	1.88 a	6.1 a	0.61	38.3 a	0.81 a

* Infestation = Centimetres of WEA infested roots per plant, Yield = Kilograms of fruit collected per plant

** Analysis was not conducted on the fruit yield values because only two replications of fruit was harvested at this site.

*** Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

PMR REPORT # 23 **SECTION A: INSECTS OF BERRY CROPS**
STUDY DATA BASE: 390 1252 9201

CROP: Strawberry, cv. Totem
PEST: European wireworm, *Agriotes obscurus*

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TITLE: GROWTH EFFECTS OF EUROPEAN WIREWORM ON TREATED AND UNTREATED STRAWBERRY PLANTS

MATERIALS: FORCE (tefluthrin 3.0G), DYFONATE (fonofos 20G), ADMIRE (imidacloprid 240 g/l)

METHODS: The study was done in a field known to be infested with European wireworm. Each plot consisted of two 5 m rows of strawberries with an untreated row between each plot. There were 16 strawberry plants per 5 m row. Treatments consisted of DYFONATE 56 g product/100m and FORCE 37.5 g product/100m drilled in 3 cm deep beside each strawberry row immediately after planting, FORCE 37.5 g product/100m scattered on the surface over the strawberry row to a 15 cm width and watered in, the equivalent of FORCE 37.5 g product/100m and 75.0 g product/100 put in the planting hole and ADMIRE 1.3 L prod/ha applied as a drench in 2000 l/ha of water immediately after planting. There were 4 replicates and treatments were arranged in a randomized block design. Strawberries were planted on June 11 and 12, 1997. One plant from each treatment was dug on July 3 and the wet weight, dry weight and root length recorded. Height and number of runners of all plants in each plot were recorded on August 12 and 13 and September 23, 1997.

RESULTS: FORCE applied in the planting hole at 37.5 g product/100 m row significantly increased the fresh weight of the strawberry plant when compared to the check. None of the remaining treatments significantly increased the wet weight, dry weight or root length of strawberry plants (Table 1). None of the treatments significantly increased the plant height or number of runners at the August sampling date. All applications of FORCE significantly increased the height of strawberry plants by the September sampling date, but there was no increase in the number of runners (Table 2).

CONCLUSIONS: FORCE at the rates and methods of application tested can significantly increase the growth of strawberry plants in a European wireworm infested field.

Table 1. Wet weight, dry weight and root length of strawberry plants treated with FORCE, DYFONATE and ADMIRE at Agassiz, B.C. in 1997.

Treatments	Application Method	Rate (prod/100 m row)	July 3, 1997 Wet wt g	Dry wt g	Root length cm
Check		---	4.8 b	1.3 a	9.0 a
DYFONATE	drilled in	56.0 g	7.9 ab	1.9 a	11.9 a
FORCE	drilled in	37.5 g	10.8 ab	2.7 a	11.8 a
FORCE	scattered	37.5 g	8.4 ab	2.1 a	11.3 a
FORCE	planting hole	37.5 g	14.1 a	3.3 a	9.0 a
FORCE	planted hole	75.0 g	10.2 ab	2.5 a	11.9 a
ADMIRE	drench	1.3 L	11.2 ab	3.0 a	9.9 a

*Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Plant Height and Runner Counts per mother plant of strawberries treated with FORCE, DYFONATE and ADMIRE. Data taken August 12, 13, 1997 and September 23, 1997at Agassiz, B.C.

Treatments	Application method	Rate (prod/100 m row)	August 12, 13, 1997		September 23, 1997	
			cm	runner count	cm	runner count
Check		---	20.8 a	1.7 a	22.3 c	4.6 a
DYFONATE	drilled in	56.0 g	24.0 a	1.5 a	26.3 abc	5.3 a
FORCE	drilled in	37.5 g	24.5 a	1.5 a	27.6 ab	5.0 a
FORCE	scattered	37.5 g	22.8 a	0.9a	28.0 ab	3.6 a
FORCE	planting hole	37.5 g	25.7 a	1.3 a	31.5 a	3.9 a
FORCE	planting hole	75.0 g	24.6 a	1.3 a	27.9 ab	4.1 a
ADMIRE	drench	1.3 L	21.6 a	1.5 a	25.7 bc	5.7 a

*Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

END OF SECTION A

SECTION B - VEGETABLES AND SPECIAL CROPS /LÉGUMES ET CULTURES SPÉCIALES

- Reports/Rapports # 24 - 36
- pages 50 - 80

Section Editor **- Jeff Tolman**

PMR REPORT # 24 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61006535

CROP: Cabbage, cv. Galaxy
PEST: Imported cabbageworm, *Pieris rapae* (L), diamondback moth, *Plutella xylostella* (L).

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TITLE: INSECT CONTROL IN CABBAGE USING RH-5992 240F

MATERIALS: RH-5992 240F (tebufenozide), COMPANION (spreader/sticker, octlphenoxyployethoxy -(9)-ethanol), MONITOR 480LC (methamidophos).

METHODS: Cabbage was planted in two-row plots in the research plots at Ridgetown College, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Plants were transplanted using a commercial transplanter on June 26, 1997. Foliar applications were applied using a specialized small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200L/ha of spray mixture on July 23, August 1, 12 and 25. Assessments were taken by counting the number of feeding sites or feeding clusters and rating insect feeding damage per plot on July 29, August 7, 19, 30 and September 14. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: RH-5992 240F provided moderate control of imported cabbageworm and diamondback moth attacking cabbage. The level of insect control was not however as effective as the standard MONITOR 480LC. The surfactant COMPANION improved the effectiveness of RH-5992 240F early in the season. Increasing the rate of RH-5992 240F from 0.3 L to 0.6 L product/ha did not significantly improve insect control.

Table 1. Control of foliar insects causing damage to cabbage.

Treatments	Rate Product/ha	Foliar Damage Ratings (0-10)[1]			# of Feeding Sites per plot[2]	
		Aug. 7	Aug. 19	Aug. 30	July 29	Sept. 14
RH-5992 240F	0.3 L	7.0 bc*	5.8 bc	5.5 b	17.3 ab	26.3 b
RH-5992 240F + COMPANION	0.3 L 0.1%v/v	8.8 a	5.8 bc	4.8 b	17.5 ab	26.5 b
RH-5992 240F + COMPANION	0.3 L 0.25%v/v	7.5 b	5.5 bc	4.5 b	18.3 ab	23.0 b
RH-5992 240F + COMPANION	0.6 L 0.1%v/v	8.5 a	6.4 b	5.5 b	14.3 b	17.3 b
RH-5992 240F + COMPANION	0.6 L 0.25%v/v	7.3 bc	6.0 bc	4.5 b	18.3 ab	18.8 b
MONITOR 480LC	1.1 L	9.0 a	9.0 a	7.1 a	20.5 a	7.3 c
CONTROL		6.5 c	4.5 c	1.5 c	17.3 ab	46.0 a
ANOVA P• 0.05		s	s	s	s	s
Coefficient of Variation (%)		7.3	15.1	18.4	15.5	24.7

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Foliar Damage Ratings (0-10) - 0, no control, foliage severely damaged; 10, complete control.

[2] # of feeding sites per plot. Number of feeding clusters counted per plot. The larger the count, the greater the damage and the less effective the treatment.

PMR REPORT # 25 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61006535

CROP: Cabbage, cv. Galaxy
PEST: Imported cabbageworm, *Pieris rapae* (L), diamondback moth, *Plutella xylostella* (L).

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TITLE: INSECT CONTROL IN CABBAGE USING SPINOSAD 480SC

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), ADMIRE 240F (imidacloprid), ORTHENE 75SP (acephate), DECIS 50EC (deltamethrin).

METHODS: Cabbage was planted in two-row plots in the research plots at Ridgetown College, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Plants were transplanted using a commercial transplanter on June 26, 1997. Foliar applications were applied using a specialized small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200L/ha of spray mixture on July 23, August 1, 12 and 25. ADMIRE 240F was side dressed, directing the spray evenly along both sides of the transplanted row, and shallowly worked in with a rake, on July 17. Assessments were taken by counting the number of feeding sites or feeding clusters and rating insect feeding damage per plot on July 29, August 7, 19, 30 and September 14. Counts and weights of marketable and undersized cabbage heads were taken on September 24 along with counting the number of insect damaged cabbage heads out of a sample of 10 heads per plot (40 total). Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Table 1 and Table 2.

CONCLUSIONS: SPINOSAD 480SC provided outstanding insect control of imported cabbageworm and diamondback moth attacking cabbage. Increasing the rate of application of SPINOSAD 480SC generally improved insect control. Late in the season, applications of SPINOSAD 480SC at or above 102 ml/ha, provided better control than the commercial standards, ORTHENE 75SP and DECIS 50EC. The sidedress application of ADMIRE 240F proved ineffective while foliar applications of ADMIRE 240F provided very poor control of foliar insect pests of cabbage.

Table 1. Control of foliar insect pests of cabbage.

Treatments	Rate Product	Method of Appli'n	Foliar Damage Ratings (0-10)[1]			# of Feeding Sites per plot[2]	
			Aug. 7	Aug. 19	Aug. 30	July 29	Sept. 14
ORTHENE 75SP	750.0 g/ha	foliar	9.0 a*	9.1 a	6.8 c	32.8 ab	15.3 c
DECIS 50EC	200.0 ml/ha	foliar	9.6 a	8.9 a	7.5 c	29.0 ab	13.0 cd
SPINOSAD 480SC	52.0 ml/ha	foliar	9.0 a	8.5 a	7.0 c	29.0 ab	16.0 c
SPINOSAD 480SC	102.0 ml/ha	foliar	9.3 a	9.1 a	8.3 b	29.5 ab	9.0 de
SPINOSAD 480SC	156.3 ml/ha	foliar	9.5 a	9.1 a	8.9 ab	29.8 ab	6.0 ef
SPINOSAD 480SC	208.3 ml/ha	foliar	8.8 a	9.1 a	9.5 a	30.5 ab	3.8 ef
SPINOSAD 480SC	416.6 ml/ha	foliar	9.4 a	9.3 a	9.5 a	26.8 b	2.8 f
ADMIRE 240F	200.0 ml/ha	foliar	7.5 b	7.8 b	4.3 d	27.0 b	27.3 b
ADMIRE 240F	8.3 ml/100m	side dress	7.5 b	6.0c	3.0 e	37.8 a	30.3 b
CONTROL			7.3 b	6.3 c	2.5 e	30.5 ab	39.5 a
ANOVA P• 0.05			s	s	s	s	s
Coefficient of Variation (%)			7.4	5.9	7.5	21.0	22.7

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Foliar Damage Ratings (0-10) - 0, no control, foliage severely damaged; 10, complete control.

[2] # of feeding sites per plot. Number of feeding clusters counted per plot. The larger the count, the greater the damage and the less effective the treatment.

Table 2. Market yield and cabbage head damage due to insects.

Treatments	Rate Product	Method of Appli'n	Yield Mkt. Size kg/plot	# of Mkt. Sized Heads	Yield Under Sized kg/plot	# of Under-Sized Heads	# of Heads w/Feeding Damage[1]
ORTHENE 75SP	750.0 g/ha	foliar	21.8 a*	16.5 ab	0.6 a	2.3 ab	3.3 c
DECIS 50EC	200.0 ml/ha	foliar	18.4 ab	16.0 ab	0.3 a	1.0 ab	4.0 c
SPINOSAD 480SC	52.0 ml/ha	foliar	18.4 ab	16.0 ab	0.7 a	3.0 a	5.0 c
SPINOSAD 480SC	102.0 ml/ha	foliar	17.8 ab	14.3 b	0.7 a	2.3 ab	3.8 c
SPINOSAD 480SC	156.3 ml/ha	foliar	21.5 a	16.3 ab	0.4 a	1.0 ab	4.3 c
SPINOSAD 480SC	208.3 ml/ha	foliar	19.9 ab	15.8 ab	0.2 a	1.5 ab	3.5 c
SPINOSAD 480SC	416.6 ml/ha	foliar	19.2 ab	14.8 b	0.2 a	0.8 ab	2.5 c
ADMIRE 240F	200.0 ml/ha	foliar	19.7 ab	16.5 ab	0.0 a	0.0 b	11.8 b
ADMIRE 240F	8.3 ml/100m	side dress	19.9 ab	17.8 a	0.2 a	0.5 ab	21.0 a
CONTROL			15.6 b	14.8 b	0.5 a	1.3 ab	12.0 b
ANOVA P• 0.05			s	s	ns	s	s
Coefficient of Variation (%)			17.9	11.2		130.1	57.1

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] # per 40 heads sampled.

STUDY DATA BASE: 303-1452-8703

CROP: Cabbage, cvs. Minicole and Houston Evergreen

PEST: Imported cabbageworm (ICW), *Artogeia rapae (L.)*; diamondback moth (DBM), *Plutella xylostella (L.)*; cabbage looper (CL), *Trichoplusia ni* (Hbn.)

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TITLE: CONTROL OF LEAF-FEEDING INSECTS ON CABBAGE

MATERIALS: SPINOSAD 480 SC (NAF85) (spinosyn A/D), TD 2344-02 0.83 EC (synthetic pyrethrinoid), DECIS 5 EC (deltamethrin), GARLIC BARRIER (garlic oil), FISH OIL.

METHODS: Cabbage seedlings were transplanted 0.5 m apart in rows 0.9 m apart on June 30, 1997. Plots, measuring 3.4 m wide and 12.2 m long, were arranged in a randomized complete block design with four replications, with the exception of the GARLIC BARRIER treatments which were isolated on the north (lee) side of the experiment. The number of leaf-feeding larvae were counted, using non-destructive sampling, on five plants each week from head initiation (July 24) until harvest (September 10). Insecticides were applied to all plots when first populations of small larvae of any of the three species were observed (August 1) and again when a threshold of 0.25 Cabbage Looper Equivalents (CLE) per plant was reached or exceeded. The numbers of ICW, CL, and DBM larvae were multiplied by 0.67, 1.0, and 0.2, respectively, to convert them to the appropriate CLE value. Insecticides were applied with a tractor-mounted CO_2-pressurized sprayer that delivered 320 L of spray volume per hectare at 240 kPa. FISH OIL at a ratio of 1:100 v/v with the water was added as a sticker to the GARLIC BARRIER treatment. After the initial treatments, insecticides were applied as follows: GARLIC BARRIER and SPINOSAD @ 25 g, 50 g, and 200 g AI/ha on August 15 and Sept. 5, SPINOSAD @ 75 g and 100 g AI/ha on September 5, and TD 2344-02 and DECIS on August 15. SPINOSAD @ 25 g AI/ha received an additional spray on August 21, while GARLIC BARRIER was applied additionally on both August 21 and August 28. Weeds were managed with a pre-plant application of trifluralin at 600 g AI/ha and with several mechanical cultivations. Marketability and head weights were recorded for ten Minicole heads harvested on September 10 from the center two rows of each plot. Heads were considered marketable if they were free of feeding damage. Analyses of variance (ANOVA) were performed on the data and the Least Squares Difference (LSD) was calculated if the ANOVA was significant at $P \leq 0.05$. The proportion of marketable heads (PM) was transformed to the sqrt(arcsine(PM)) before analysis. Detransformed means are presented.

RESULTS: Results are summarized in the table that follows.

CONCLUSIONS: The seasonal averages for first and second instars, fifth instars, diamondback moth larvae, and CLE on plants treated with all rates of SPINOSAD, TD 2344-02, and DECIS were significantly lower than the mean number of insects found on the untreated CHECK and on plants treated with GARLIC BARRIER (Table 1). Relative to the CHECK, significantly fewer third and fourth instars were observed on plants treated with GARLIC BARRIER (Table 1). However, GARLIC BARRIER was not as efficacious against third and fourth instars as were any rate of SPINOSAD, TD 2344-02, or DECIS. Marketable yields in excess of at least 70% of the heads harvested were observed in plots treated with SPINOSAD at 75, 100, and 200 g AI/ha, TD 2344-02, and DECIS. GARLIC BARRIER did not effectively manage leaf-feeding pests of cabbage. No phytotoxicity was observed for any of the materials used in this trial.

Table 1. Marketable yields of cabbage and seasonal averages for leaf-feeding pests of cabbage treated with several insecticides and rates of insecticides.

Treatment	Rate (g ai/ha)	ICW1-2	ICW3-4	ICW5	CL	DBM	CLE	% MARKET
Check		0.98a*	0.63a	0.47a	0.01	2.25a	1.84a	0e
SPINOSAD 480 SC	25	0.28b	0.05c	0.01b	0.01	0.34b	0.30b	63cd
SPINOSAD 480 SC	50	0.24b	0.14c	0.05b	0.00	0.29b	0.34b	55d
SPINOSAD 480 SC	75	0.13b	0.06c	0.00b	0.01	0.23b	0.18b	73cd
SPINOSAD 480 SC	100	0.21b	0.09c	0.01b	0.01	0.26b	0.26b	70cd
SPINOSAD 480 SC	200	0.11b	0.03c	0.01b	0.00	0.25b	0.15b	83bc
TD 2344-02 0.83 EC	33	0.15b	0.01c	0.01b	0.00	0.33b	0.18b	98a
DECIS 5 EC	10	0.14b	0.01c	0.00b	0.01	0.32b	0.18b	93ab
GARLIC BARRIER	----	0.76a	0.39b	0.41a	0.00	2.17a	1.47a	0e
ANOVA $P \leq 0.05$		----	----	----	ns	----	----	----

* Numbers are the means of four replications. Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

PMR REPORT # 27 **SECTION B: INSECT PESTS**
OF VEGETABLES AND SPECIAL CROPS
STUDY DATA BASE: 280-1252-9304

CROPS: Cabbage, cv. Lennox
Broccoli, cv. Fiesta
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF SEED COATINGS FOR CONTROL OF CABBAGE MAGGOT ATTACKING CABBAGES AND BROCCOLI IN MINERAL SOIL - 1997

MATERIALS: REGENT 200 F (fipronil), GOVERNOR 75 WP (cyromazine), SNIPER 50 WP (azinphosmethyl), thiram/carbendazim, iprodione + metalaxyl

METHODS: Commercial film seed coatings, containing fungicides ±insecticide, were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. Coated seed was single-seeded into Cornell 17 plug-mix media in 200 cell plug- propagation trays at Simcoe, ON, on April 3. Seedlings were grown to the 4-leaf stage in the greenhouse at Simcoe. On May 22, seedlings were transplanted into 2-row microplots (2.25 m long x 0.9 m wide), filled with insecticide residue-free mineral soil, at the London Research Farm. Each row contained 15 transplants. All treatments received 100 ml starter fertilizer (soluble 10-52-10 [N-P-K] at 2.5 g/L) in the planting hole; insecticide for Tmt. 5 was added to the starter fertilizer. Separate experiments were established for cabbage and broccoli. All treatments were replicated three times in a randomized complete block design. On May 22-23, 10-15 CM eggs from an insecticide-susceptible strain, originally collected near Chatham, ON, were buried 1 cm deep beside 10 of 15 plants in 1 row in each plot. Infested plants were identified with a dated stake. The second row in each broccoli plot was similarly infested and identified on June 3-5 and in each cabbage plot on June 10-13. On June 19 (broccoli I, II, cabbage I) and June 25 (cabbage II), infested plants were carefully dug, roots washed and rated for CM feeding damage (0 - no damage; 1 - scarring ± moderate surface tunnelling; no significant stunting; 2 - scarring ± moderate surface tunnelling resulting in plants at least 25% smaller than largest plants in plot; 3 - dead or dying plant). Numbers of plants with ratings of 0 and 1 were summed, percentage of total plants calculated and data subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Untransformed data are presented.

RESULTS/OBSERVATIONS: CM feeding damage to cabbage and broccoli roots following insecticide application in seed coating or planting water is shown in Table 1. below. Minor symptoms of phytotoxicity (slight yellowing of older leaves and minor growth delay) were observed in cabbage transplants 8-9 days after planting; symptoms were outgrown within 3-4 days.

CONCLUSIONS: In both infestations, application of SNIPER 50WP in the transplant water provided nearly complete protection of both cabbage and broccoli roots from CM. With one minor exception (cabbage I), inclusion of either rate of REGENT 200F in the seed coating, also significantly reduced CM feeding to cabbage/broccoli roots. Inclusion of GOVERNOR 75WP in the seed coating did not significantly decrease CM damage to cabbage/broccoli roots.

RESIDUE ANALYSIS: Cabbage and broccoli not infested with CM eggs were grown to maturity. Broccoli and soil were collected from all plots for Tmt. 3, 4 and 6 on July 30 to determine whether fipronil could be detected at harvest. The procedure was repeated for cabbage on August 28. Analyses are not yet complete.

Table 1. Effect of seed coatings or planting treatment on damage to cabbage and broccoli roots by cabbage maggot, 1997.

No.	Insecticide in Seed Coating	Rate (g AI/ kg seed)	Mean % "Good Roots"* for Indicated Vegetable/Infestation			
			Cabbage		Broccoli	
			Infestation I	Infestation II	Infestation I	Infestation II
1.	GOVERNOR	50.0	53.3 c**	83.3 ab	46.7 b	45.2 cd
2.	GOVERNOR	75.0	63.3 bc	85.8 ab	50.0 b	63.9 bcd
3.	REGENT	10.0	100.0 a	93.3 a	96.7 a	86.7 abc
4.	REGENT	20.0	96.7 ab	100.0 a	96.3 a	90.0 ab
5.	SNIPER	0.1***	100.0 a	100.0 a	96.7 a	100.0 a
6.	CONTROL	---	72.6 bc	60.0 b	50.9 b	33.0 d

* Roots with a rating of 0 (no damage) or 1 (scarred root surface ± moderate surface tunnelling that did not cause stunting of plant.

** Means within a column followed by the same letter are not significantly different (P• 0.05) as determined by Duncan's New Multiple Range Test.

*** Planting Water treatment; 0.1 g AI/plant in 100 ml/plant.

PMR REPORT # 28 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**

CROP: Cabbage *Brassica oleracea capitata* var. Cavalier

PESTS: Cabbage Looper (CL), *Trichnoplusia ni*;
Imported Cabbage Worm (ICW), *Artogeia rapae* (L.);
Diamondback moth (DBM), *Plutella xylostella* (L.).

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TITLE: RELATIVE EFFICACY OF VARIOUS RATES OF SPINOSAD 480SC AND DECIS 25 EC FOR CONTROL OF COMMON INSECT PESTS OF COLE CROPS.

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), DECIS 25EC (deltamethrin)

METHODS: Cabbage seed was planted in a seed bed at the Cambridge Research Farm, on May 14, 1997. Seedlings were transplanted into 4 row plots, 12.0 m in length with a row spacing of 0.9m on June 26. Treatments were replicated four times in a randomized complete block design. Plots were separated by 3.0 m spray lanes. Foliar insecticide applications were applied using a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. The first insecticide application of all treatments was made on August 15 when insect pests were beginning to appear in the field. A second application of all treatments was made on August 29. Counts of CL, ICW and DBM larvae were taken on 5 heads of cabbage per plot on August 19, 25, September 2, and 11. These counts were converted into Cabbage Looper Equivalents (CLE) per head using the following formula: CLE = (1x # of CL larvae/head) + (0.67 x # of ICW larvae/head) + (0.2 x # DBM larvae/head). On September 17, 5 heads per plot were harvested and graded according to a 1-6 rating scale where ratings less than or equal to three are marketable and greater than three were unmarketable. Results were analyzed using Duncan's Multiple Range Test (p• 0.05).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: All treated plots had significantly lower CLE values than the untreated check plot. There was no difference in insect control among the various rates of SPINOSAD 480SC and DECIS 25EC. The grading results at harvest indicate that while there was no significant difference among heads in all treatments, numerical results (>3) suggest that heads in the untreated check plot were not marketable.

Table 1. Effect of insecticide applications on Cabbage Looper Equivalents (CLE) and harvest rating scale values.

Treatments	August 19 CLE/Head	August 25 CLE/Head	September 2 CLE/Head	September 17 CLE/Head	Harvest Rating (1-6)
DECIS 10 g ai/ha	0.26 b	0.19 b	0.04 b	0.11 b	2.40 a
SPINOSAD 25 g ai/ ha	0.21 b	0.38 b	0.07 b	0.03 b	2.90 a
SPINOSAD 50 g ai/ ha	0.32 b	0.23 b	0.00 b	0.00 b	2.55 a
SPINOSAD 75 g ai/ ha	0.07 b	0.08 b	0.05 b	0.02 b	2.65 a
SPINOSAD 100 g ai/ ha	0.18 b	0.05 b	0.00 b	0.03 b	2.55 a
SPINOSAD 150 g ai/ ha	0.09 b	0.08 b	0.00 b	0.03 b	2.75 a
Untreated Check	0.69 a	2.38 a	1.27 a	0.92 a	3.30 a

* Treatment means followed by the same letter are not significantly different (p=0.05, Duncans New MRT).

PMR REPORT # 29 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
ICAR#: 206003

CROP: Yellow cooking onions, cv. Fortress and Norstar
PEST: Onion maggot, *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF TRANSPLANTED ONION LINES FOR ONION MAGGOT FLY RESISTANCE, 1997

MATERIALS: Onion breeding lines obtained from Dr. I. Goldman, University of Wisconsin, Dr. Rob Maxwell, Petoseed, Payette, Idaho and two commercial cultivars, Fortress and Norstar.
LORSBAN 4E (chlorpyrifos 40%)

METHODS: Twenty-four onion lines were seeded into 288 plug trays on 24 Mar and 1 Apr. The trial was conducted at the Muck Crops Research Station where onion maggot flies are naturally present. The transplants were planted out on 13, 14 and 15 May in a randomized complete block arrangement with four blocks per treatment. Each replicate consisted of two rows (42 cm apart), 5 m in length. Each plant was planted at 10 cm spacing. Fortress and Norstar were used as commercial comparisons for the trial. Fortress and Norstar were treated with the following: 1.6 ml of LORSBAN 4E per tray in 500 ml of water (full rate), 3.2 ml of LORSBAN 4E per tray in 500 ml of water (2 x rate) and an untreated check. No other insecticides were applied during the trial. Damage assessments began approximately one week after the first generation peak (24 Jun) of onion maggot flies. Damage was assessed once a week by rogueing out wilted onions and looking for symptoms of maggot damage at the base of the plant. Final damage assessments were done on 28 and 29 Aug. Harvest weights were taken for all remaining onions on 19 Sep. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant differences in onion maggot damage and yield were found among the onion lines. Maggot damage on untreated commercial lines Fortress and Norstar was relatively low and yields were not significantly different from the insecticide treated onions. Untreated Norstar onions did have more total maggot damage than Norstar onions that were drenched with LORSBAN 4E in the tray. Onion lines PS 650096, PS 650196 and PS 650396 had low levels of onion maggot damage and high yields.

Table 1. Impact of onion maggot on transplanted yellow cooking onion lines at the Muck Crops Research Station, Bradford, Ontario , 1997.

Treatment	1st Generation	2nd Generation	Total Percent Damaged	Harvest Yield kg /10 m
Fortress Check	5.79 a-e*	2.30 abc	14.5 a-e	21.39 a-f
Fortress full rate LORSBAN 4E	0.23 a	0.0 a	0.50 a	24.18 a-d
Fortress 2 x rate LORSBAN 4E	0.73 ab	0.98 a	2.0 ab	19.73 c-h
Fortress GOVERNOR 75WP	3.89 a-e	0.48 a	3.50 abc	21.97 a-e
101-96	10.86 b-f	4.93 cde	25.25 efg	19.15 d-h
102-96	8.81 a-e	2.45 a-d	18.5 c-f	20.17 b-g
104-96	7.31 a-e	1.0 a	16.75 b-f	18.53 c-h
105-96	8.24 a-e	0.98 a	15.5 a-e	16.84 f-i
910-97	21.1 fg	5.28 e	31.75 fg	12.69 i-l
912-97	21.76 g	5.25 e	37.0 g	7.81 l
914-97	12.58 d-g	4.95 cde	27.5 efg	10.93 kl
916-97	14.18 efg	2.35 a-d	25.5 efg	11.30 jkl
918-97	12.33 c-g	5.0 de	27.5 efg	12.81 i-l
920-97	5.31 a-e	4.53 b-e	16.25 b-e	12.64 i-l
924-97	5.82 a-e	2.18 ab	14.0 a-e	14.66 h-k
PS WR456	5.33 a-e	1.23 a	14.0 a-e	12.20 i-l
PS 650096	2.15 abc	1.18 a	9.25 a-d	25.07 ab
PS 650196	4.20 a-e	1.88 ab	15.0 a-e	24.78 abc
PS 650296	8.60 a-e	1.50 a	20.75 def	21.28 a-f
PS 650396	2.92 a-d	0.73 a	9.25 a-d	25.0 ab
PS W457	1.68 ab	2.35 a-d	9.75 a-d	16.08 g-j
Norstar Check	8.76 a-e	0.70 a	17.0 b-f	25.74 a
Norstar full rate LORSBAN 4E	0.0 a	0.00 a	0.75 a	21.19 a-g
Norstar 2 x rate LORSBAN 4E	0.0 a	0.0 a	1.75 ab	25.93 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 30 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**

ICAR #: 206003

CROP: Yellow cooking onions, cv. Fortress and Taurus

PEST: Onion maggot, *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF SEEDED ONION LINES FOR ONION MAGGOT FLY RESISTANCE, 1997

MATERIALS: Onion breeding lines obtained from Dr. I. Goldman, University of Wisconsin, Dr. Rob Maxwell, Petoseed, Payette, Idaho and Asgrow Canada. Three commercial cultivars Norstar, Fortress and Hamlet were also used as checks.
LORSBAN 15G, (chlorpyrifos 15%), GOVERNOR 75WP (cyromazine 75%)

METHODS: Thirty-one lines were direct seeded (46 seeds/m) on 21 and 23 May. The trial was conducted at the Muck Crops Research Station where onion maggot flies are naturally present. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 2 rows (43 cm apart), 2 m in length. Norstar, Fortress and Hamlet were used as commercial comparisons for the trial. Cultivars Norstar and Fortress were treated with the following:
32 g LORSBAN 15G per 100 m row (8 kg/ha-half rate), 64 g LORSBAN 15G per 100 m row (16 kg/ha-full rate), 128 g LORSBAN 15G per 100 m row (32 kg/ha-2 x full rate), 256 g LORSBAN 15G per 100 m row (64 kg/ha-4 x full rate). GOVERNOR 75WP was applied to Fortress and Hamlet seed. Untreated checks were also included. No other insecticides were applied throughout the trial period. Germination counts were conducted on 16 Jun. Damage assessment began at first generation peak (24 Jun) of onion maggot flies. Maggot damage was assessed once a week by rogueing out wilting onions and looking for symptoms of maggot damage at the base of the plant. Final damage assessments were done on 30 Sep. Harvest weights were taken 24 Oct. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant differences in percent maggot damage and yields were found among onion lines. Onions with the lowest total maggot damage were Hamlet treated with GOVERNOR 75WP, Fortress treated with the full rate and four times the full rate of LORSBAN 15G and Norstar treated with twice the recommended rate of LORSBAN 15G. Onion lines 920-97 and PS WR 456 also had lower overall maggot damage. The half rate of LORSBAN 15G did not effectively reduce onion maggot damage, but several of the LORSBAN 15G treatments were effective. GOVERNOR 75WP seed treatment reduced maggot damage compared to the untreated Hamlet onions, except at the third generation assessment. On Fortress onions, the GOVERNOR 75WP treatment reduced the third generation and total damage. Yields of Norstar onions were higher than any of the other lines. Insecticide treatments did not result in increased yields. Some of the experimental lines such as 101-96 produced yields similar to those of Fortress.

Table 1. Impact of onion maggot on direct seeded yellow cooking onion lines, 1997.

Treatment		Generation		Total damage	Harvest yield (kg)/4m
	1st	2nd	3rd		
Fortress Check	12.9 a-g*	9.4 c-g	39.4 fgh	43 e-i	4.27 e-i
Fortress ½ rate LORSBAN 15G	14.8 a-i	3.6 a-d	34.9 e-h	38 c-i	3.76 f-j
Fortress full rate LORSBAN 15G	2.6 a	0.8 a	14.1 a-d	15 a	4.60 e-h
Fortress 2 x rate LORSBAN 15G	5.8 a-d	2.4 a-d	24.0 a-f	27 a-e	4.89 c-g
Fortress 4 x rate LORSBAN 15G	3.6 ab	4.6 a-c	9.8 abc	16 a	5.28 c-f
Fortress GOVERNOR 75WP	5.7 a-d	11.8 efg	8.9 ab	26 a-d	3.59 f-k
101-96	29.3 jkl	7.3 a-f	26.0 a-f	48 f-j	4.07 e-i
102-96	34.5 ml	8.0 a-f	28.4 b-f	49 g-j	3.35 f-k
104-96	22.1 f-k	11.6 efg	34.6 e-h	48 f-i	3.76 f-j
105-96	26.6 i-l	8.6 b-f	29.3 c-g	48 f-i	4.22 e-
910-97	15.4 b-i	14.6 fgh	53.9 hij	53 ij	0.86 m
912-97	17.5 c-j	1.8 abc	48.6 ghi	34 b-g	0.65 m
914-97	9.7 a-e	13.7 fgh	30.8 d-g	37 c-i	2.15 h-m
916-97	16.7 c-i	7.3 a-f	30.8 d-g	39 d-i	2.66 g-m
918-97	15.3 b-i	5.5 a-c	39.1 fgh	41 d-i	1.53 i-m
920-97	9.4 a-e	2.2 a-d	20.2 a-f	24 abc	2.55 g-m
924-97	14.1 a-i	8.2 a-f	31.4 d-g	34 b-f	1.17 lm
PS WR456	5.5 abc	7.2 a-f	27.8 b-f	26 a-e	1.42 jkl
PS 650096	14.3 a-i	5.5 a-e	75.4 k	34 b-f	3.96 e-i
PS 650196	33.1 kl	9.8 d-g	66.2 ijk	51 hij	3.29 f-l
PS 650296	20.3 e-j	16.7 gh	68.0 ijk	49 g-j	3.28 f-l
PS 650396	46.5 m	13.7 fgh	63.9 ijk	64 j	2.80 g-m
PS W 457	14.0 a-i	2.4 a-d	72.9 jk	32 b-f	2.55 g-m
Norstar Check	26.0 h-l	21.0 h	70.4 jk	53 ij	4.28 e-i
Norstar ½ rate LORSBAN 15G	21.0 e-k	11.8 efg	20.1 a-f	40 d-i	7.72 b
Norstar full rate LORSBAN 15G	17.8 d-j	7.8 a-f	21.5 a-f	37-b-h	7.10 bc
Norstar 2 x rate LORSBAN 15G	10.1 a-f	4.7 a-e	16.2 a-e	37 a-e	7.06 bc
Norstar 4 x rate LORSBAN 15G	6.5 a-d	3.4 a-d	4.6 a-d	21 ab	10.11 a
XPH 15055	13.8 a-h	9.4 c-g	28.1 b-f	39 c-i	6.02 b-e
Hamlet GOVERNOR 75WP	5.2 abc	1.3 ab	7.1 a	12 a	6.84 bcd
Hamlet Check	22.7 g-l	13.7 fgh	20.0 a-f	42 e-i	4.67 d-h

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* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 31 **SECTION B:** **INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Yellow cooking onions cv, Hamlet and Prince
PEST: Onion maggot, *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF GOVERNOR 75 WP AND REGENT 200F FOR CONTROL OF ONION MAGGOT DAMAGE, 1997

MATERIALS: REGENT 200F (fipronil), GOVERNOR 75WP (cyromazine 75%), LORSBAN 15G (chlorpyrifos 15%)

METHODS: Onions were direct seeded into organic soil on 14 and 15 May, 1997 at the Muck Crops Research Station where onion maggot flies are naturally present. A randomized complete block arrangement with four replications per treatment was used. Each replicate consisted of 1 row, 20 m in length. The cultivar Hamlet was treated with GOVERNOR 75WP. Prince was treated with REGENT 200F. Each cultivar was treated with LORSBAN 15G at 16 kg/ha (full rate) and LORSBAN 15G at 32 kg/ha (2 x rate). An untreated check was also included. A 2 m section was marked off for assessment of each of the three generations of onion maggot fly. Stand counts of each section were taken after emergence to determine initial stand. Damage assessments began one week after first generation peak (24 Jun) of onion maggot flies. Maggot damage was assessed once a week by rogueing out wilted onions and looking for symptoms of maggot damage at the base of the plant. On 22 Jul the first generation sections were harvested and assessment was done on all remaining plants. At the end of the second and third generation all the plants were harvested from the designated 2 m sections in each row and assessed for damage. On 8 Oct the remaining 14 m were harvested to determine yield. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

CONCLUSIONS: The insecticide treatments reduced total onion maggot damage on both cultivars and there were no significant differences in control between GOVERNOR 75 WP and REGENT 200F and the two rates of LORSBAN 15G. However, the insecticide treatments did not significantly reduce second or third generation maggot damage on cv. Hamlet, and on Prince, only the high rate of LORSBAN 15G reduced first and second generation damage compared to the untreated checks. No treatment significantly increased yields compared to the untreated check. Yields of REGENT 200F treated Prince were significantly lower than the other treatments, even though onion maggot damage was relatively low. Higher levels of onion smut may have been responsible for the reduction in yield in this treatment.

Table 1. Impact of onion maggot on cv. Hamlet at the Muck Crops Research Station, Bradford, Ontario, 1997.

Treatment	1st Generation	2nd Generation	3rd Generation	Total Damage	Yield kg/14 m
Control	52.6 b*	27.9 a	10.6 a	46.4 b	49.2 ab
GOVERNOR 75WP	15.6 a	16.3 a	6.6 a	16.8 a	30.4 b
LORSBAN 15G at 16 kg/ha	23.8 a	12.8 a	1.7 a	18.3 a	52.0 ab
LORSBAN 15G at 32 kg/ha	11.5 a	9.6 a	0.3 a	8.3 a	55.6 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 2. Impact of onion maggot on cv. Prince at the Muck Crops Research Station, Bradford, Ontario, 1997.

Treatment	1st Generation	2nd Generation	3rd Generation	Total Damage	Yield kg/14 m
Control	48.4 b	26.5 b	14.7 b	51.8 b	83.5 a
REGENT 200F	21.3 ab	16.3 ab	1.7 a	15.4 a	19.2 c
LORSBAN 15G at 16 kg/ha	24.9 ab	18.5 ab	2.5 a	21.3 a	49.5 b
LORSBAN 15G at 32 kg/ha	16.8 a	8.0 a	1.8 a	11.7 a	67.5 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 32 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9304

CROP: Cooking onion, cv. Prince
PEST: Onion maggot (OM), *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF SEED COATINGS FOR CONTROL OF ONION MAGGOT ATTACKING COOKING ONIONS IN ORGANIC SOIL - 1997

MATERIALS: REGENT 200 F (fipronil), GOVERNOR 75 WP (cyromazine), PRO GRO (carbathiin + thiram), thiram

METHODS: Commercial film seed coatings, containing insecticide + PRO GRO/thiram, were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. All seed was planted at the London Research Farm on May 7 in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil. All treatments were replicated three times in a randomized complete block design. On June 2 a total of 250 OM eggs from an insecticide-susceptible strain, originally collected on the Thedford Marsh, were buried 1 cm deep beside one onion row in each plot. The infested row length was delineated by stakes and the number of onion plants was counted. Infestations to remaining rows were repeated on June 3 and 4. Surviving onion plants were counted 4 weeks after each infestation and the percent loss calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Untransformed data are presented.

RESULTS/OBSERVATIONS: See Table 1. below. Inclusion of GOVERNOR 75WP in the seed coating appeared to delay onion-germination. Twenty five days after planting, an average of 36% fewer seedlings were counted in plots planted with GOVERNOR-treated seeds than in CONTROL plots.

CONCLUSIONS: For all infestations, numbers of onion seedlings remaining after 4 weeks were significantly higher when the seed coating included REGENT 200F. Inclusion of GOVERNOR 75WP in the seed coating significantly reduced loss of onion seedlings only in Infestation I.

RESIDUE ANALYSIS: Samples of onions and soil were collected from all plots for Tmt. 2 and 3 on September 25 to determine whether fipronil could be detected at harvest. Analyses are not yet complete.

Table 1. Effect of seed coatings on onion stand loss due to onion maggot, 1997.

No.	Insecticide in Seed Coating	Rate (g AI/ kg seed)	Mean % Onion Loss after Indicated Infestation		
			Infestation I (June 2)	Infestation II (June 3)	Infestation III (June 4)
1.	GOVERNOR 75WP	50.0	22.1 b*	18.2 ab	48.5 a
2.	REGENT 200F	25.0	2.3 c	1.0 b	10.3 b
3.	CONTROL	---	76.5 a	41.8 a	63.1 a

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined by Duncan's New Multiple Range Test.

PMR REPORT # 33 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9304

CROP: Radish, cv. Scarlet Globe Rebel
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF SEED COATINGS FOR CONTROL OF CABBAGE MAGGOT ATTACKING RADISHES IN MINERAL SOIL - 1997

MATERIALS: REGENT 200 F (fipronil), GOVERNOR 75 WP (cyromazine), LORSBAN 480 E (chlorpyrifos), thiram/carbendazim, iprodione + metalaxyl

METHODS: Commercial film seed coatings, containing insecticide + fungicides, were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. On May 7 at the London Research Farm a single row of radish (60 seeds/m) was planted down the centre of microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated three times in a randomized complete block design. On May 21 a row of cabbage transplants was planted on both sides of the emerging radish row in each plot. On May 26 a total of 250 CM eggs from an insecticide-susceptible strain, originally collected near Chatham, ON, were buried 1 cm deep beside a portion of the radish row in each plot. The infested row length was delineated by stakes and the number of radish plants was counted. Infestation to the remainder of the row was repeated on June 2. All radishes from both infestations were harvested on June 16. Roots were washed, counted, weighed, inspected for CM damage and the percent roots showing any feeding damage calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Untransformed data are presented.

RESULTS/OBSERVATIONS: CM feeding damage and mean radish weight/root are shown in Table 1. below. Inclusion of GOVERNOR 75WP in the seed coating both delayed and reduced emergence of radish seedlings. In addition, many of the weakened seedlings that did emerge failed to develop. While REGENT200F at 10.0 g AI/kg seed slightly retarded inital emergence of radish seedlings, the delay could not be detected after 4 days.

CONCLUSIONS: All seed coatings significantly reduced CM damage to radish in Infestation I. Dry weather conditions reduced survival of maggots from introduced eggs in Infestation II; only 15.5% of radishes in CONTROL plots were damaged. Only the higher rate of application of GOVERNOR 75WP and REGENT 200F significantly reduced CM feeding damage in Infestation II. In Infestation II, the higher rates of application of both GOVERNOR 75WP and REGENT 200F provided better control of CM damage than the lower rates. While radish size was quite variable, roots were generally smaller in plots planted with seed coated with GOVERNOR 75WP. Due to phytotoxicity, GOVERNOR 75WP should not be developed as a seed coating for radish.

RESIDUE ANALYSIS: Samples of radishes and soil were collected from all plots for Tmt. 3-6 on June 16 to determine whether fipronil or chlorpyrifos could be detected at harvest. Analyses are not yet complete.

Table 1. Effect of seed coatings on damage to radish roots by cabbage maggot, 1997.

No.	Insecticide in Seed Coating	Rate (g AI/ kg seed)	Mean Radish Response for Indicated Infestation			
			Infestation I		Infestation II	
			% Damage	Wt/Root (g)	% Damage	Wt/Root (g)
1.	GOVERNOR	50.0	7.2 b*	5.90 bc	18.0 a	5.77 c
2.	GOVERNOR	75.0	1.4 b	5.50 c	0.9 b	6.80 c
3.	REGENT	5.0	2.6 b	9.80 abc	8.8 ab	14.30 ab
4.	REGENT	10.0	1.7 b	10.50 ab	3.3 b	11.20 abc
5.	LORSBAN	9.6	2.5 b	12.20 a	20.1 a	16.80 a
6.	CONTROL	---	38.5 a	8.47 abc	15.5 a	10.10 bc

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined by Duncan's New Multiple Range Test.

PMR REPORT # 34 **SECTION B: INSECT PESTS OF VEGETABLES and SPECIAL CROPS**
ICAR: 6100653

CROP: Rutabaga, cv. Laurentian
PESTS: Imported cabbageworm, *Artogeia rapae* (L)
Flea beetle, *Phyllotreta pusilla* (L)

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TITLE: FOLIAR INSECT CONTROL IN RUTABAGAS

MATERIALS: ADMIRE 240F, (imidacloprid), VYDATE L (oxamyl), RH-5992 240F (tebufenozide), METASYSTOX-R 240SC (oxydemeton-methyl), CYGON 480E (dimethoate), THIODAN 4EC (endosulfan), LORSBAN 15G (chlorpyrifos), SEVIN XLR PLUS (carbaryl), CYMBUSH 250EC (cypermethrin), DIPEL 2XDF (*Bacillus thuringiensis var. kurstaki*).

METHODS: Rutabagas were seeded in three-row plots, 8 m in length with rows spaced 0.75 m apart, replicated four times in a randomized complete block design. Plots were established at the Huron Research Station near Centralia on June 5, 1997. Foliar spray applications were applied using a specialized small plot research CO_2 sprayer with a two-nozzled, hand-held boom, applying 200 L/ha of spray mixture on July 7, 16, 29, August 13 and 27. Assessments were made by rating the amount of damage caused by flea beetles and general foliage feeders on July 15, August 19 and September 18. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: The most effective products for control of imported cabbageworm and flea beetle foliar damage on rutabagas were METASYSTOX-R 240SC, and THIODAN 4E. The next level of effectiveness was SEVIN XLR PLUS, LORSBAN 4E, CYMBUSH 250EC and CYGON 480E. Foliar insect damage was not significantly reduced following applications of ADMIRE 240F, VYDATE L, RH-5992 240F or DIPEL 2XDF.

Table 1. Foliar damage ratings for imported cabbageworm and flea beetle attacking rutabagas.

Treatments	Rate L Product/ ha	Foliar Damage Rating (0-10)[1]		
		July 15 September 18	August 19	
ADMIRE 240F	0.1	4.8 a*	3.5 de	4.5 e
ADMIRE 240F	0.2	5.0 a	2.8 e	4.8 de
VYDATE L	3.0	4.5 a	6.9 c	5.3 de
RH-5992 240F	0.6	4.5 a	3.8 de	4.8 de
METASYSTOX-R 240SC	2.25	4.8 a	8.5 ab	9.0 a
CYGON 480E	0.7	5.0 a	7.8 abc	6.3 cd
THIODAN 4EC	2.0	4.3 a	9.0 a	8.5 ab
LORSBAN 4E	2.4	5.0 a	6.8 c	8.5 ab
SEVIN XLR PLUS	2.5	4.3 a	7.3 bc	7.3 bc
CYMBUSH 250EC	0.2	5.0 a	8.8 a	6.3 cd
DIPEL 2XDF	1.1	4.8 a	4.5 d	4.5 e
CONTROL		4.3 a	3.5 de	4.5 e
ANOVA P• 0.05		ns	s	s
Coefficient of Variation (%)			14.4	16.5

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Foliar Damage Rating (0-10) -0; no control, foliage severely damaged; 10: complete control.

PMR REPORT # 35 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1241-9580

CROP: Flue-cured tobacco, cv. Delfield
PEST: Tobacco aphid (TA), *Myzus nicotianae*

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TITLE: PLANTING AND FOLIAR INSECTICIDES FOR CONTROL OF APHIDS ATTACKING FLUE-CURED TOBACCO - 1997

MATERIALS: ADMIRE 240 F (imidacloprid), ORTHENE 75 SP (acephate), GOLD LEAF C-10 680 g/L (n-decanol)(sucker control agent)

METHODS: Control of TA by both planting (Table 1) and foliar insecticides (Table 2) was investigated on the Delhi Research Farm of the Pest Management Research Centre. With the exception of Tmt. 3, Table 1, tobacco seedlings were grown in a glass-greenhouse in muck seedbeds, precision-seeded with pelletized seed on March 25. Seedlings for Tmt. 3, Table 1 were grown singly in PRO MIX BX propagation media in 288-cell Styrofoam float trays, placed in the float tanks in a double poly-house on March 28. On May 27, Tmt. 3, Table 1 was applied at 150 kPa in 40 L/100 m^2 and washed from tobacco foliage into the propagation media with 240 L/100 m^2 clear water, using a single-nozzled, CO_2-pressurized, R&D precision sprayer fitted with an 8002EVS flat fan spray tip . Tobacco seedlings had been clipped to a height of 15-18 cm. On May 29 all treatments were transplanted with a single row Delhi Foundry planter, in a randomized complete block design with 4 replications. Each plot contained 4 rows of 36 plants; only the centre 2 rows were treated and subsequently sampled for bioassay. Tmt. 1, 2, 4, Table 1 were applied in 100 ml transplant water/plant. All other treatments received 100 ml clear transplant water/plant. On 29 July, Tmt. 1 and 2, Table 2, were applied to topped tobacco at 345 kPa in 280 L/ha using a HAHN HI-BOY high clearance sprayer, travelling at 5.5 km/h, fitted with 3 x TX12 hollow cone spray tips/row, 1 centred over the row and 1 directed inwards on a 30 cm drop-pipe on each side of the row. On the same date, Tmt. 2-5, Table 2, were applied to topped tobacco at 100 kPa in 450 L/ha using a HAHN HI-BOY high clearance sprayer, travelling at 5.5 km/h, fitted with a 3-nozzle boom over each row, 1 x TG5 full cone spray tip centred over the row and 1 x TG3 full cone spray tip directed downwards at 45• on either end of the 0.7 m boom. Residual effectiveness of all treatments was measured by bioassay at varying times after application (Tables 1,2). On each assay date, 5-cm diameter leaf discs were punched from either the youngest leaf large enough to permit collection of a sample without severing the mid-rib (Table 1) or the third leaf from the severed top of the stalk (Table 2). On each collection date a total of 12 bioassays (3 bioassays/plot x 4 plots/tmt.), each containing 1 leaf disc on 50 cc moist (10% wt/wt) silica sand and 10 mature, wingless TA from a stock culture, was established for each treatment. Bioassays were held at 23• C, 60% RH, and 16:8 L:D photoperiod. For each bioassay the number of surviving mature TA and the number of nymphs produced were recorded after 48 hrs. The number of nymphs/surviving TA and the "Population Expansion Potential" (= No. surviving TA x No. Nymphs/Surviving TA) were then calculated for each bioassay. Statistical significance of effect of treatments on numbers of surviving TA and numbers of nymphs/surviving TA was determined by analysis of variance; Least Squares Differences (LSD) were calculated and used to estimate significance of differences among treatment means.

RESULTS/OBSERVATIONS: See Table 1a-c and 2a-c. below for results of measurement, by bioassay of effectiveness of planting and foliar insecticides. Throughout the growing season, field TA populations were too low and too uneven to permit collection of meaningful field data. Obvious phytotoxicity was seen at no time during these experiments.

CONCLUSIONS: Under the conditions of the experiment, all planting treatments significantly reduced survival of introduced TA on leaf discs collected 4 days after planting (DAP)(Table 1a). While both insecticides applied in the transplant water (TW) reduced TA-survival, ORTHENE appeared to be taken up more rapidly since fewer TA survived on discs collected from ORTHENE-treated plots. By 4 DAP, application of ADMIRE to plants in float trays (TR) 3 days prior to transplanting resulted in TA mortality equal to that observed following TW-application of ORTHENE (Table 1a). While TW-application of ORTHENE did not significantly reduce survival of introduced TA beyond 11 DAP all applications of ADMIRE reduced TA-survival until 25 DAP. Only the higher rate of TW-application of ADMIRE reduced TA-survival 32 DAP (Table 1a). The indirect impact of insecticide application on production of nymphs by introduced TA generally lasted longer than direct toxicity of the treatment to the insect (Cf. Table 1a, 1b). All treatments significantly reduced the number of nymphs/living female for 25 DAP (Table 1b). As measured by significant reduction of nymph production, the observed order of persistence was ADMIRE - TW (60.0 ml)(53 days) > ADMIRE - TW (30.0 ml)(46 days) = ADMIRE -TR (30 ml)(46 days) > ORTHENE - TW (75.0 g)(25 days)(Table 1b). TR-application of ADMIRE proved more effective than TW-application since the insecticide was already present in the foliage at transplanting. In addition, until 46 DAP, TR-application of ADMIRE at 30.0 ml/1,000 plants was as effective as TW-application of ADMIRE at 60.0 ml/1,000 plants (Table 1b). By considering both TA-survival and the fecundity of surviving TA, Population Expansion Potential (PEP) provides a convenient method to visualize the potential economic impact of TA moving into treated tobacco plots. PEP's for all treatments were markedly reduced until 25 DAP. Thereafter, PEP's followed the pattern described for production of nymphs by surviving TA (Table 1c).

Foliar treatments were not as effective as planting treatments (Cf. Table 1, 2). On Day 0 only Tmt. 4 and 5 significantly reduced survival of introduced TA in bioassay (Table 2a). Survival of introduced TA was significantly reduced for 10 days following application of ORTHENE + GOLD LEAF (Table 2a). For Tmt. 2 and 4 the impact of foliar treatments on production of nymphs by surviving TA was more persistent than the direct impact on TA survival (Cf. Table 2a, b). While statistical significance of reductions in PEP was not estimated, as defined by at least 25% reduction in PEP, the order of persistence for foliar treatments was ORTHENE + GOLD LEAF (14 days) > ADMIRE (115 ml, 230 ml) + GOLD LEAF (10 days) = ADMIRE (230 ml)(10 days) > ADMIRE (115 ml)(3 days)(Table 2c). Tested rates of foliar application of ADMIRE were thus not as effective as the recommended rate of foliar application of ORTHENE.

RESIDUE ANALYSIS: Samples of dried tobacco from all ADMIRE-treatments have been collected to determine whether imidacloprid could be detected after curing and processing. Analyses are not yet complete.

Table 1a. Effect of "Planting Treatments" on survival of introduced Tobacco Aphid, *Myzus nicotianae*.

Tmt. No.	Treatment Applied	Rate (/1000 plants)	Mean No. Surviving Females on Indicated Day after Planting								
			4	11	18	25	32	39	46	53	60
1.	ADMIRE - TW***	30.0 ml	4.4 c*	2.3 b	3.4 a	8.3 b	9.5 c	9.1 a	9.7 ab	9.6 a	**
2.	ADMIRE - TW	60.0 ml	2.1 b	2.9 b	3.4 a	6.4 a	7.0 a	8.1 a	9.8 b	9.8 a	10.0 a
3.	ADMIRE - TR****	30.0 ml	0.3 a	0.9 a	3.5 a	6.8 b	8.5 b	8.8 a	9.2 a	9.8 a	**
4.	ORTHENE - TW	75.0 g	0.3 a	1.9 ab	8.9 b	9.3 bc	9.7 c	9.2 a	9.8 b	**	**
5.	CONTROL	----	9.8 d	9.5 c	9.7 b	9.4 c	9.1 bc	9.1 a	9.4 ab	9.8 a	9.8 a

Table 1b. Effect of "Planting Treatments" on production of living nymphs by introduced Tobacco Aphid, *Myzus nicotianae*.

Tmt. No.	Treatment Applied	Rate (/1000 plants)	Mean No. Living Nymphs/Surviving Female on Indicated Day after Planting								
			4	11	18	25	32	39	46	53	60
1.	ADMIRE - TW***	30.0 ml	0.50 a*	0.28 a	0.58 ab	1.35 b	1.48 a	3.32 b	2.59 b	7.75 b	**
2.	ADMIRE - TW	60.0 ml	0.79 a	0.03 a	0.07 a	0.24 a	0.33 a	1.10 a	1.55 a	4.95 a	6.82 a
3.	ADMIRE - TR****	30.0 ml	0.25 a	0.08 a	0.08 ab	0.06 a	0.30 a	2.02 ab	0.98 a	6.58 b	**
4.	ORTHENE - TW	75.0 g	0.06 a	0.21 a	0.96 b	1.48 b	5.10 b	6.43 c	4.77 c	**	**
5.	CONTROL	----	6.60 b	0.94 b	2.81 c	4.93 c	5.54 b	7.88 c	5.40 c	7.03 b	7.36 a

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

** Bioassay not done due to high survival of introduced TA in preceding series of tests.

*** Application in **T**ransplant **W**ater.

**** Application to plants in float **TR**ay.

Table 1c. Effect of "Planting Treatments" on Population expansion potential* of introduced Tobacco Aphid, *Myzus nicotianae*.

Tmt. No.	Treatment Applied	Rate (/1000 plants)	Mean Population Expansion Potential on Indicated Day after Planting								
			4	11	18	25	32	39	46	53	60
1	ADMIRE - TW***	30.0 ml	2.2	0.9	3.7	11.7	14	31.5	24.9	73.8	**
2	ADMIRE - TW	60.0 ml	1.6	0.2	0.3	1.6	2.3	8.7	15.1	48.3	68.1
3	ADMIRE - TR****	30.0 ml	0.3	0.1	0.4	0.4	2.6	17.4	9	64.4	**
4	ORTHENE - TW	75.0 g	0.1	0.3	8.9	14	49.4	57.9	46.7	**	**
5	CONTROL	----	64.3	9.1	27.1	46.2	49.9	70.9	50.8	68.7	72.3

* Population Expansion Potential = No. Nymphs/Surviving Female x No. Surviving Females in a Bioassay.

** Bioassay not done due to high survival of introduced TA in preceding series of tests.

*** Application in **T**ransplant **W**ater.

**** Application to plants in float **TR**ay.

Table 2a. Effect of Foliar treatments on survival of introduced Tobacco Aphid, *Myzus nicotianae*.

Tmt. No.	Treatment Applied	Rate (pdct. /ha)	Mean No. Surviving Females on Indicated Day after Treatment				
			0	3	7	10	14
1	ADMIRE	115 ml	9.5 c	9.0 bc	9.8 c	**	**
2	ADMIRE	230 ml	8.5 bc	9.0 bc	9.6 bc	8.5 b	8.2 a
3	ADMIRE + GOLD LEAF	115 ml + 16.8 L	9.3 bc	9.5 c	9.5 bc	8.8 b	9.3 b
4	ADMIRE + GOLD LEAF	230 ml + 16.8 L	8.0 ab	8.3 b	9.3 bc	8.8 b	9.6 b
5	ORTHENE + GOLD LEAF	1.1 kg + 16.8 L	6.8 a	3.5 a	4.8 a	2.9 a	8.8 ab
6	CONTROL	----	9.8 c	9.0 bc	8.5 b	9.5 b	9.0 ab

Table 2b. Effect of foliar treatments on production of living nymphs by introduced Tobacco Aphid, *Myzus nicotianae*.

Tmt. No.	Treatment Applied	Rate (pdct. /ha)	Mean No. Living Nymphs/Surviving Female on Indicated Day after Treatment				
			0	3	7	10	14
1	ADMIRE	115 ml	1.3 b*	4.6 ab	6.3 c	**	**
2	ADMIRE	230 ml	0.2 a	4.2 a	3.9 b	4.3 b	3.4 ab
3	ADMIRE + GOLD LEAF	115 ml + 16.8 L	1.3 b	5.0 ab	3.3 ab	5.3 b	4.6 b
4	ADMIRE + GOLD LEAF	230 ml + 16.8 L	1.1 ab	2.9 a	2.8 ab	2.5 a	3.9 ab
5	ORTHENE + GOLD LEAF	1.1 kg + 16.8 L	1.8 b	4.6 ab	1.9 a	4.1 ab	3.0 a
6	CONTROL	----	6.6 c	6.6 b	3.6 ab	7.6 c	4.0 ab

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

** Bioassay not done due to high survival of introduced TA in preceding series of tests.

Table 2c. Effect of foliar treatments on population expansion potential* of introduced Tobacco Aphid, *Myzus nicotianae*.

Tmt. No.	Treatment Applied	Rate (pdct. /ha)	Mean Population Expansion Potential on Indicated Day after Treatment				
			0	3	7	10	14
1	ADMIRE	115 ml	12.6	42.2	61.3	**	**
2	ADMIRE	230 ml	2	38.3	37.7	36	27.8
3	ADMIRE + GOLD LEAF	115 ml + 16.8 L	12.1	47.4	30.9	46.3	42.6
4	ADMIRE + GOLD LEAF	230 ml + 16.8 L	8.6	23.2	25.8	21.8	37.7
5	ORTHENE + GOLD LEAF	1.1 kg + 16.8 L	13.8	16	10.1	11	26
6	CONTROL	----	65.1	59.9	72.4	72.5	35.3

* Population Expansion Potential = No. Nymphs/Surviving Female x No. Surviving Females in a Bioassay.

** Bioassay not done due to high survival of introduced TA in preceding series of tests.

PMR REPORT # 36 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1241-9580

CROP: Flue-cured tobacco, cv. Delfield (Site 1); AC-Cheng (Site 2)
PEST: Eastern field wireworm (EFW), *Limonius agonus* (Say)

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TITLE: **PLANTING WATER INSECTICIDES FOR CONTROL OF WIREWORM ATTACKING FLUE-CURED TOBACCO - 1997**

MATERIALS: ADMIRE 240 F (imidacloprid), ORTHENE 75 SP (acephate), REGENT 200F (fipronil)

METHODS: Trials were established on sandy loam near Tillsonburg, ON (Site 1) on June 10 and near Mt. Bridges, ON (Site 2) on June 12 in fields previously planted by the cooperating grower. All treatments were replicated 4 times in a Randomized complete block design. Plots measured 15 m long and consisted of a single row of 14-16 plants individually located between established plants. Insecticides were applied in 150 ml planting water/plant; CONTROL plots received 150 ml clear planting water/plant. Individual transplants were established in planting holes as soon as possible after adding planting water. On June 26 (Site 1) and July 2 (Site 2) experimental plants were carefully dug from the soil, loose dirt shaken from the roots and tops trimmed approximately 5 cm above ground level. All roots were returned to the laboratory and carefully washed . Roots and underground portions of the stem were scored for EFW feeding damage using a 0-4 scale (0 - no feeding damage; 1 - <5% of root/stem area surface-scarred; 2 - 6%-20% of root/stem area surface scarred; 3 - 20%+ of root/stem area surface scarred ± 1 tunnel or area with feeding to depth of ca. 1 mm; 4 - 20%+ of root/stem area surface scarred + more than 1 tunnel or area with feeding to depth of ca. 1 mm **OR** 1 deep tunnel or larger feeding area reaching beneath the cortex of the root/underground stem). Numbers of plants with ratings of 0 and 1 were summed and the number of plants with a rating of 4 counted. The percentage of total plants in both categories calculated and data subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Untransformed data are presented.

RESULTS: The effect of planting water treatments on EFW feeding damage to tobacco seedlings is shown in Table 1. No symptoms of phytotoxicity were noted in any treatment.

CONCLUSIONS: While EFW were active at both sites, significant differences in feeding damage among treatments were recorded only at Site 2. At Site 2, the percentage of plants with clean or minimally damaged roots was numerically but not significantly lowest in CONTROL plots. With the exception of Tmt. 3 (REGENT - 30.0 ml/1,000 plants), addition of insecticide to the planting water significantly reduced the numbers of plants with serious EFW feeding damage (Rating = 4). While the trend was not statistically significant, feeding damage was generally less severe in plots receiving the higher rate of application of both ADMIRE and REGENT. Both REGENT and ADMIRE proved as effective as the commercial standard, ORTHENE, for control of EFW feeding damage. No planting water treatment, however, eliminated damage by this soil pest.

Table 1. Effect of planting water insecticides on feeding damage to roots and underground stems of flue-cured tobacco by Eastern field wireworm, *Limonius agonus*.

Tmt. No.	Treatment Applied	Rate (amt/1,000 plants)	% Tobacco Roots with Indicated Root Ratings**			
			Site 1		Site 2	
			0 + 1	4	0 + 1	4
1	ADMIRE 240F	40.0 ml	67.1 a*	6.7 a	63.3 a	6.7 bc
2	ADMIRE 240F	80.0 ml	56.7 a	15.0 a	69.2 a	3.3 c
3	REGENT 200F	30.0 ml	40.8 a	20.0 a	60.5 a	16.3 ab
4	REGENT 200F	45.0 ml	59.3 a	13.0 a	64.8 a	5.0 bc
5	ORTHENE 75SP	75.0 g	66.2 a	10.1 a	67.7 a	8.8 bc
6	CONTROL	----	45.0 a	21.7 a	42.4 a	33.3 a

[*] Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

[**] Damage Rating (0-4 scale where 0 represents no feeding damage; 1 represents <5% of root/stem area surface-scarred; 2 represents 6%-20% of root/stem area surface scarred; 3 represents 20%+ of root/stem area surface scarred ± 1 tunnel or area with feeding to depth of ca. 1 mm; 4 represents 20%+ of root/stem area surface scarred + more than 1 tunnel or area with feeding to depth of ca. 1 mm **OR** 1 deep tunnel or larger feeding area reaching beneath the cortex of the root/underground stem).

END OF SECTION B

SECTION C - POTATOES/POMMES DE TERRE

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- Pages 81 - 143

Section Editor - **Jeff Stewart**

PMR REPORT # 37

SECTION C: INSECT PESTS OF POTATOES
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PESTS: Buckthorn aphid, *Aphis nasturtii* Kaltenbach
Potato aphid, *Macrosiphum euphorbiae* (Thomas)
Green peach aphid, *Myzus persicae* (Sulzer)

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TITLE: EFFECT OF ADMIRE ON THE SPREAD OF POTATO LEAFROLL VIRUS (PLRV)

MATERIALS: ADMIRE 240 F (imidacloprid)

METHODS: Plots consisted of 12, 45.7 m long rows spaced 0.9 m apart. Treatments were arranged in a randomized block design with three replications. The Soil treatment consisted of an in-furrow application of ADMIRE at planting, the Foliar treatment received mid-season applications of foliar ADMIRE, and the Check treatment received no ADMIRE applications. Each block was divided into six sample blocks, six rows wide by 14 m long. Potatoes 10% infected with PLRV were planted on June 2, 1997, at 0.46 m within row spacing. ADMIRE (0.03 g AI/m row) was applied in-furrow by a soil applicator with 80015 fan nozzles at planting. Foliar pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, and equipped with three D4-45 nozzles per row, with an application volume of 400 L/ha, and a speed of 6 kph. A plastic (4 mil) lined trench surrounding the 9 blocks, 8 m from the block edges was installed on June 5 to trap colonizing Colorado potato beetles. On June 18 a pre-emergence herbicide (LINURON, 3 L product/ha) was applied. BRAVO (2.4 L product/ha) was applied on July 11 for the management of plant pathogens. NOVODOR, (8 L product/ha except 16 L product/ha on July 8) for Colorado potato beetle control, was applied to the Foliar and Check treatments on July 8 and 11, to the Check treatment on July 15, 23, 30 and August 5, to control Colorado potato beetles. ADMIRE (200 mL product/ha) was applied to the Foliar treatment on July 15 and July 30. The plots were top-killed with REGLONE (2.75 L product/ha) on Sept 8. The number of potato plants and the number of potato plants showing leafroll virus symptoms per sample plot were counted on July 16 and Aug 27-29. Only one replicate of the check treatment was examined for virus symptoms in the Aug 27-29 reading since drought stress masked virus symptoms in the other two replicates. The mean and standard error of the three blocks per treatment are reported here. Aphid flight into the plots was monitored with yellow pan traps. One trap was placed per plot between rows six and seven, 14 m from the east or west end of the plot. Trap position alternated east and west between plots. Traps were emptied twice a week from July 4 to Aug 29, and the number of potato, buckthorn, green peach, and other aphids were counted. Data expressed as proportions were converted with the arcsine transformation before analyses of variance or t-tests. Detransformed means are presented.

RESULTS: There were no significant differences in the percentage of plants showing leafroll virus symptoms between treatments on July 16, at the start of the test, or on Aug 27-29, at the end of the season. There was no increase of virus incidence from July 16 to Aug 27-29 regardless of treatment (Table 1). Treatment means are presented in Tables 1 and 2.

CONCLUSIONS: The absence of increase in the percentage of plants infected with PLRV in spite of a 11% inoculum may be due to the small number of green peach aphids present in the field between July 16 and Aug 27 (Table 2). This aphid is generally considered the most important aphid vector of PLRV. Together with the last two years' field trials, these results suggest that in-furrow or foliar applications of ADMIRE will not promote the spread of PLRV but nor will it, like other insecticides, play a significant role in suppressing PLRV spread. Tubers have been harvested and will be tested to confirm field readings.

Table 1. Mean percentage of plants showing PLRV symptoms on July 16 and Aug 27-29 per treatment.*

Date	Treatment		
	Soil	Foliar	Check
July 16	11.0	11.8	11.6
Aug 27-29	11.4	11.6	9.2

* Figures are means of three replications except one replicate for the check on Aug 27-29. Numbers in a row or column were not significantly different.

Table 2. Mean number buckthorn, potato, green peach, and other aphids caught in yellow pan traps per treatment.*

Date	Buckthorn			Potato			Green Peach			Other		
	S	F	C	S	F	C	S	F	C	S	F	C
7/04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.3	0.7
7/08	0.0	0.0	0.0	0.3	0.7	0.0	0.7	0.0	0.0	5.0	8.3	1.0
7/11	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	7.0	1.0	5.7
7/15	1.0	0.3	0.3	3.0	3.3	2.0	0.7	0.3	0.7	16.3	11.0	13.0
7/18	0.0	0.3	0.3	0.3	1.0	0.3	0.0	0.0	0.0	7.0	11.0	7.7
7/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.3	10.3	11.0
7/25	0.0	0.7	0.3	0.0	0.0	0.3	0.0	0.0	0.0	6.7	7.3	3.3
7/29	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	8.3	8.3
8/01	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	12.0	10.3	7.7
8/05	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	17.0	15.3
8/08	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	13.3	10.0	17.3
8/12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	11.0	13.7	17.7
8/15	0.3	0.0	0.7	1.7	1.7	0.7	0.0	0.0	0.0	17.7	21.3	33.3
8/19	2.0	1.3	0.7	0.7	2.7	0.3	0.7	1.3	2.0	83.0	77.0	92.7
8/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.3	14.7	18.3	28.7
8/26	0.3	1.0	0.7	0.0	0.0	0.0	0.0	0.7	1.0	40.0	95.7	86.3
8/29	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.0	0.3	49.0	66.0	63.3

* Figures are means of three replicates. No statistical analysis done. S=soil, F=foliar, C=check.

PMR REPORT # 38 **SECTION C: INSECT PESTS OF POTATOES**
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EFFECT OF ALERT ON ARTHROPOD PREDATORS AND PARASITES IN POTATO FIELDS

MATERIALS: ALERT 2SC (chlorfenapyr)

METHODS: Plots consisted of 10, 9.1 m long rows spaced 0.9 m apart. There were 13 (Site 1) or 14 (Site 2) replications in 0.6 ha blocks in each of the ALERT treatment and Integrated Pest Management (IPM) treatment blocks. The ALERT and IPM blocks were separated with 15 m of bare soil. Site 1 was planted on May 25, 1997, and Site 2 was planted on June 5, 1997 both at a 0.46 m within row spacing. Pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, and equipped with three D4-45 nozzles per row, with an application volume of 400 L/ha, and a speed of 6 kph. A plastic (4 mil) lined trench surrounded the IMP blocks, 8 m from the block edges was installed on June 5 (Site 1) and on June 9 (Site 2) to trap colonizing Colorado potato beetles (CPB). A pre-emergence herbicide (LINURON, 3 L product/ha) was applied to both treatments on June 11 (Site 1) and on June 18 (Site 2). BRAVO (2.4 L product/ha) was applied to both treatments on July 11 (Site 1) and on July 12 (Site 2) for the management of plant pathogens. ALERT (150 g AI/ha) was applied to the ALERT treatment blocks in Sites 1 and 2 on July 12 and July 29. NOVODOR, (8 L product/ha) for CPB control, was applied to the IPM treatment at Site 2 on July 12, 15 and 29, and to the IPM treatment at Site 1 on July 12. MYCOTROL (2.4 L product/ha) and NOVODOR (4 L product/ha) was applied to the IPM treatment at Site 1 on July 15 and 29 for CPB control. A scout walked between the rows of each plot of both treatments at both Sites at a speed of roughly 9 m/min and recorded the number of naturally occurring arthropod predators or parasites visible on the surface of the potato leaves in both rows, on July 18 and August 1. The mean number of Coccinellidae and of all arthropod predators and parasites counted on each date and each Site for the ALERT and the IPM treatments were analysed with t-tests (P• 0.05).

RESULTS: The July 18 survey found: ladybird beetle adults (Coleoptera: Coccinellidae - mainly *Coccinella septempunctata* L., also found were *Coccinella trifasciata* L., and *Propylea quatuordecimpunctata* L.); hover fly adults (Diptera: Syrphidae); hymenopterans; spiders; and reduviids (Hemiptera: Reduviidae). The August 1 survey found: ladybird beetle adults, larvae and pupae (Coleoptera: Coccinellidae - adults were mainly *Coccinella septempunctata* L., also found were *Harmonia axyridis* (Pallas), *Coccinella trifasciata* L., and *Propylea quatuordecimpunctata* L.); hover fly adults and larvae (Diptera: Syrphidae); hymenopterans; spiders; reduviids (Hemiptera: Reduviidae); *Podius maculiventris* (Say) (Hemiptera: Pentatomidae); and another unidentified predatory hemipteran. Treatment means for the number of Coccinellidae and all arthropod predators and parasites are presented in Table 1.

CONCLUSIONS: Two applications of the insecticide ALERT had no adverse effect on the index of abundance of predators and parasites at two sites where the control of Colorado potato beetles by insecticide alone was compared to alternative control methods alone. There was a consistent trend for more predators in the plots treated with ALERT than in the others. These observations suggest that ALERT may be compatible with IPM programs based on the encouragement or the release of natural enemies.

Table 1. Mean number of Coccinellidae and all arthropod predators or parasites found per plot in each treatment at each Site on July 18 and August 1.*

Treatment	July 18				August 1			
	Site 1		Site 2		Site 1		Site 2	
	Cocc.	All	Cocc.	All	Cocc.	All	Cocc.	All
ALERT	0.8	1.2	0.3	0.4	4.4	5.0	5.6	6.0
IPM	0.2	0.5	0.1	0.4	2.8	3.3	4.6	4.6

* Figures are means of 13 (Site 1) or 14 (Site 2) replications. Numbers in a column were not significantly different.

PMR REPORT # 39

SECTION C: INSECT PESTS OF POTATOES
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: COLORADO POTATO BEETLE CONTROL TECHNIQUES

MATERIALS: SPINOSAD 480SC (spinosyn), ADMIRE 240FS (imidacloprid), plastic lined trench (4 mil black mulching), extruded plastic trap

METHODS: Plots consisted of four, 7.3 m long rows spaced at 0.9 m. The treatments were completely randomized with four replications, except the Untreated Check which had six replications. Potatoes were planted June 4, 1997, at a within row spacing of 0.4 m. ADMIRE (222 g AI/ha and 333 g AI/ha) was applied in-furrow by a soil applicator with 80015 fan nozzles at planting. The trenches were installed by June 10 whereas the extruded plastic traps were installed by June 13. The inner edge of either the plastic-lined trench or the extruded plastic traps were 0.9 m from the plots. Foliar pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, equipped with three D4-45 nozzles per row, at an application volume of 400 L/ha, and a speed of 6 kph. On June 18, a pre-emergence herbicide (LINURON, 2.5 L product/ha) was applied. The Trench and Extruded Trap treatments, which were to be kept within a defoliation rating of 2 (see Table 2) were sprayed with NOVODOR (8 L product/ha) on July 16, 23 and 30. SPINOSAD (40 g AI/ha and 80 g AI/ha) was applied on July 7 and 16 to keep the defoliation rating at 2 or lower. Maintenance sprays of ADMIRE 240FS were made to all treatments on Aug 8 and 19. BRAVO (2.4 L product/ha) was applied to all plots to control late blight on July 11. Colorado potato beetle (CPB) life stages were counted once a week from June 21 to Aug 19 on 10 randomly chosen plants in the middle two rows of each plot. The defoliation rating of the middle two rows of a plot was taken once a week from June 28 to Sept 3. The plants were top-killed with REGLONE (2.75 L product/ha) on Sept 8 and the middle two rows of each plot were harvested on Oct 7. Analyses of variance and LSD tests were carried out on the data.

RESULTS: The treatment means are presented in the Tables 1 and 2. The population of colonizing overwintered CPB adults was low at the Potato Research Centre in the 1997 season and heavy rainfall during June and July retarded CPB development. The CPB population did start building up in late July when defoliation in the Untreated Check increased (Table 2).

CONCLUSIONS: All treatments were superior to the Untreated Check and equivalent to one another in reducing summer generation CPB adults and larvae, but none of the treatments resulted in yield increases that were significantly different from the Untreated Check. The two SPINOSAD treatments gave only short term control of CPB larvae. The rate of application had little impact on the efficacy of ADMIRE or SPINOSAD (the 80 g AI/ha rate was marginally superior to the 40 g AI/ha rate). No differences were observed between the two barriers with respect to their effectiveness in controlling the CPB.

Table 1. The mean number of various CPB life stages per 10 plants and the mean total weight yield in tonnes per hectare.*

Treatment	Rate (g AI/ha)	L2	L3	L4	Adults	Total Yield
		16/07	23/07	30/07	20/08	
Trench	-	34.5	20.5 b	32.8 b	1.8 b	33.9
Trap	-	bc	7.3 b	23.8 b	2.3 b	
ADMIRE 240FS	222.0	90.3	10.8 b	140.3 a	7.5 b	
ADMIRE 240FS	333.0	ab	3.8 b	36.5 b	4.3 b	
SPINOSAD 480SC	40.0	11.0 c	15.3 b	18.8 b	14.8 b	
SPINOSAD 480SC	80.0	1.3 c	0.8 b	6.3 b	1.0 b	
Untreated Check	-	34 [illegible]	103.8 a	162.2 a	80.4 a	
ANOVA P• 0.05	-	bc	---	---	---	
		39.8				
		bc				
		133.2 a				

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* Figures are means of 4 replications, except 6 for the Untreated Check. Means followed by the same letter are not significantly different according to a LSD test (P• 0.05).

Table 2. The mean defoliation ratings of the middle two rows of the treatment plots throughout the sampling period.*

Treatment	Rate (g a.i/ha)	35467	35679	23/07	35588	35802	27/08
Trench	-	0.8bc	1.3ab	2.0b	1.4	1.0c	1.0d
Trap	-	1.0ab	1.1ab	1.5bc		1.3c	1.3cd
ADMIRE 240FS	222.0	0.5bc	1.0b	1.5bc		5.0a	3.3b
ADMIRE 240FS	333.0	0.3c	1.0b	1.0c		3.0b	2.8bc
SPINOSAD 480SC	40.0	1.0ab	1.3ab	1.5bc		3.3b	3.8b
SPINOSAD 480SC	80.0	1.0ab	1.3ab	1.3bc		2.8b	2.8bc
Untreated Check	-	1.3a	1.4a	5.8a		5.8a	6.0a
ANOVA P• 0.05	-	---	---	---		---	---

* Figures are means of 4 replications, except 6 for the Untreated Check. Means followed by the same letter are not significantly different according to a LSD test (P• 0.05).

Defoliation ratings: (0) no defoliation;
(1) 2-60% of plants with leaflets slightly damaged;
(1.5) >60% of plants with leaflets slightly damaged;
(2) 2% of plants with • 1 compound leaf with • 50% defoliation;
(3) 2-9% of plants with • 1 stem with • 50% defoliation;
(4) 10-24% of plants with • 1 stem with • 50% defoliation;
(5) 25-49% of plants with • 1 stem with • 50% defoliation;
(6) 50-74% of plants with • 1 stem with • 50% defoliation;
(7) 75-99% of plants with • 1 stem with • 50% defoliation.

PMR REPORT # 40

SECTION C: INSECT PESTS OF POTATOES
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: CONTROL OF COLORADO POTATO BEETLES WITH AN EXPERIMENTAL FORMULATION OF *BEAUVERIA BASSIANA*.

MATERIALS: MYCOTROL GH-ES (*Beauveria bassiana* Strain GHA), BELMARK 300EC (fenvalerate)

METHODS: Plots consisted of 10, 9.1 m long rows spaced at 0.9 m. There were 13 replications of each treatment (experimental fungal insecticide, pyrethroid insecticide), in 0.6 ha fields. The 8 replications of the Untreated Check plots were isolated plots consisting of four, 7.3 m long rows spaced at 0.9 m, located in a field 600 m from the treated field. Potatoes were planted May 25, 1996, at a within row spacing of 0.46 m in the MYCOTROL and BELMARK treatment plots; the Untreated Check plots were hand planted at 0.41 m spacing on May 29. On June 3 a plastic lined trench was installed 9.1 m from the edge of the MYCOTROL treatment field edges. Pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, equipped with three D4-45 nozzles per row, at an application volume of 400 L/ha, and a speed of 6 kph. On June 7, a pre-emergence herbicide (LINURON, 2.5 L product/ha) was applied to all plots. A post-emergence herbicide (FUSILADE, 2 L product/ha) was applied on July 2 to the MYCOTROL and BELMARK treatment plots and on July 7 to the Untreated Check plots. DITHANE (2.2 kg product/ha) was applied to all plots on July 7 and to the Untreated Check plots on July 18 and 29 to control fungal pathogens. BRAVO (2.4 L product/ha) was applied to the MYCOTROL and BELMARK treatment plots on July 18 and 25 to control fungal pathogens. MYCOTROL (2.5 L product/ha) with a wetting agent, SILWET (0.16 L product/ha), was applied to the MYCOTROL treatment plots on July 12 and 22. BELMARK was applied to the BELMARK treatment plots on July 12 (0.1 L product/ha) and 22 (0.33 L product/ha). Colorado potato beetle (CPB) life stages were counted twice a week from July 9 to July 26 in the MYCOTROL and BELMARK treatment plots on 20 randomly chosen plants. In the Untreated Check plots CPB life stages were counted once a week from July 10 to July 29 on 10 randomly chosen plants in the middle two rows of each plot; the resulting number was multiplied by two for ease in comparison with the treatment plots. The defoliation rating (see Table 2) of the plots were taken on the same dates. T-tests were carried out on the MYCOTROL and BELMARK treatment plot data; the Untreated Check data are included for reference only. MYCOTROL was supplied by Mycotech Corporation, Butte, Montana.

RESULTS: The treatment means are presented in the Tables 1 and 2. The population of colonizing overwintered CPB adults was low at the Fredericton Research Centre in the 1996 season and heavy rainfall during June and July retarded CPB development. The CPB population did start building up in late July when defoliation in the Untreated Check increased (Table 2).

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CONCLUSIONS: The MYCOTROL treatment was as effective as the BELMARK treatment at reducing the abundance of the different instars (Table 1) of the CPB and at protecting the plant from damage (Table 2). The population dynamics of the CPB beetle in 1996 were affected by the unusually wet and cold weather early in the season. The first and second instars normally expected during the last week of June did not reach level where control was necessary before the second to third weeks of July. This delayed application of the MYCOTROL to the time when fungicide sprays against late blight were required, especially in such wet weather. The fungicide was applied 48 hours after the MYCOTROL to minimize negative interactions. There is no doubt that this may have affected the level of control obtained. The level of plant defoliation suggest that the MYCOTROL formulation of *B. bassiana* was as effective as BELMARK at protecting plant foliage (Table 2). The tendency for the defoliation index to be lower for MYCOTROL than for BELMARK may be the continuation of a trend existing before the first application of MYCOTROL on July 12. Defoliation data from a nearby field provide information on the impact of an unmanaged CPB population on potato plants. The low abundance of the CPBs before and following the first treatment resulted in a limited amount of plant damage in the main study site and in the adjacent one. Later in the season, beginning after the second treatment with MYCOTROL, the increasing abundance of large larvae in the untreated field led to the characteristic explosion in defoliation. In the treated plots, the defoliation index remained low suggesting that the consistent control of the young larvae over a 10 day period from July 12 to July 22 had resulted in a smaller population of the damaging large larvae.

Table 1. The mean number of various CPB life stages per 20 plants.*

Treatment	L1	L2	L3	L4	Adults
	16/07	16/07	19/07	23/07	23/07
MYCOTROL GH-ES	54.85	8.92	16.15	15.8	0.08
BELMARK 300EC					
T-test P• 0.05	ns	ns	ns	ns	ns
Untreated Check	97.5	92.26	57.76	136.26	0.26

* Figures are means of 13 replications, except 8 for the Untreated Check. There were no significant differences between the MYCOTROL and BELMARK treatments for any date or life stage according to a t-test (P• 0.05).

Table 2. The mean defoliation ratings of the middle two rows of the treatment plots throughout the sampling period.*

Treatment	36044	36135	16/07	19/07	23/07	26/07
MYCOTROL GH-ES BELMARK 300EC	0.96	-1.23	1.54	1.77	2.08	2.08
T-test P• 0.05	ns	ns	ns	ns	ns	ns
Untreated Check	1.44	1.33	1.25	1.3	2.5	3.82

* Figures are means of 13 replications, except 8 for the Untreated Check. There were no significant differences between the MYCOTROL and BELMARK treatments for any date or life stage according to a t-test (P• 0.05).

Defoliation ratings: (0) no defoliation;
(1) 2-60% of plants with leaflets slightly damaged;
(1.5) >60% of plants with leaflets slightly damaged;
(2) 2% of plants with • 1 compound leaf with • 50% defoliation;
(3) 2-9% of plants with • 1 stem with • 50% defoliation;
(4) 10-24% of plants with • 1 stem with • 50% defoliation.

PMR REPORT # 41 **SECTION C: INSECT PESTS OF POTATOES**

CROP: Potatoes, cv. Shepody
PEST: Colorado potato beetle, *Lepinotarsa decemlineata* (Say)

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TITLE: EFFICACY OF VARIOUS RATES OF SPINOSAD 480C AGAINST COLORADO POTATO BEETLE (CPB) LARVAE, COMPARED WITH ADMIRE 240F AND RIPCORD 400EC ON MUCK SOIL

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), ADMIRE 240F (imidacloprid), RIPCORD 400EC (cypermethrin)

METHODS: Potato seed pieces were planted at the Bradford Marsh Muck Crops Research Station on May 27, 1997, in 4 row plots, 5 m in length with a row spacing of 0.9 m. Treatments were replicated four times in a randomized complete block design. Foliar insecticide applications were applied using a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 45 kPa. Forty CPB egg masses were flagged on July 1 and checked daily to determine hatch. By July 8, 30% of the egg masses had hatched. Treatments were applied on July 8. Assessments were made by counting the number of CPB larvae and % defoliation on each of five plants per plot, on July 15, 22, and 29. Potatoes were harvested on September 30, and total yield in t/ha was calculated for each treatment. Results were analyzed using the Duncan's Multiple Range Test ($P \leq 0.05$).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: Up to 14 days post-application, all treatments provided effective control of CPB larvae compared to the untreated check. By day 21, none of the plants in the treated plots had significantly fewer larvae compared to the untreated check plot. There were no significant differences in the effectiveness of any of the rates of SPINOSAD 480C tested. Plants in all treated plots had significantly less defoliation than those in the untreated check plots for the duration of the experiment. By day 21, defoliation rates in the SPINOSAD 480C treatments, with the exception of 60 g AI/ha, were statistically comparable to the ADMIRE 240F and RIPCORD 400EC treatments. The SPINOSAD 480C 80 g AI/ha and ADMIRE 240F were the only treatments that had significantly higher yields than the untreated check.

Table 1. Treatment comparison of mean larval counts and percent defoliation post-treatment, and total yield data in t/ha in muck soil.

Treatment	July 15 (Day 7)		July 22 (Day 14)		July 29 (Day 21)		Yield
	# Larvae	% Def	# Larvae	% Def	# Larvae	% Def	Tonnes/ Hectare
Untreated Check	22.30a*	4.80a	31.50a	27.25a	8.40a	33.50a	13.68b
Spinosad 40 g AI/ha	4.80bc	1.50bc	7.60bc	7.00cd	9.05a	14.80bc	19.73ab
Spinosad 60 g AI/ha	5.70bc	2.00bc	9.70bc	11.75bc	13.60a	23.30ab	18.76ab
Spinosad 80 g AI/ha	5.40bc	1.00bc	6.30bc	8.75c	6.60a	6.80c	21.76a
Spinosad 160 g AI/ha	4.15bc	1.30bc	8.50bc	8.25c	8.70a	5.80c	19.11ab
Spinosad 40 g AI/ha + Bravo 2.25 L prod/ha	15.55ab	2.80b	14.05b	16.25b	16.75a	16.30bc	17.46ab
Ripcord 35 g AI/ha	1.80c	1.00bc	9.10bc	4.90cd	15.85a	9.30c	19.51ab
Admire 0.2 L prod/ha	3.90bc	0.50c	1.05c	1.25d	6.25a	4.50c	22.76a

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$ Duncans New MRT).

CROP: Potatoes, cv. Shepody
PEST: Colorado potato beetle, *Lepinotarsa decemlineata* (Say)

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TITLE: TIMING COMPARISONS - CONTROL OF THE COLORADO POTATO BEETLE (CPB) USING SPINOSAD 480SC COMPARED WITH ADMIRE 240F AND RIPCORD 400EC

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), ADMIRE 240F (imidacloprid), RIPCORD 400EC (cypermethrin)

METHOD: Potato seed pieces were planted at the Cambridge Research Farm, on May 6, 1997, in 4 row plots, 14.0 m in length with a row spacing of 0.9 m. Treatments were replicated four times in a randomized complete block design. Plots were separated by 3.0 m spray lanes. Foliar insecticide applications were applied using a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. Treatments 2 to 6 were considered early applications whereas treatments 7 to 11 were considered late applications. One hundred CPB egg masses were flagged on June 20 and checked daily to determine hatch. By June 23, 30% of the egg masses were hatched. The initial spray of treatments 2 to 6, 12 and 13 was applied on June 23. There was an excess of 20 mm of rain within three hours of completing this spray resulting in the re-application of these treatments on June 25. Second applications of treatments 4 to 6 and first applications of treatments 7 to 11 were made on July 2 after larval counts and defoliation estimates were taken. A final application to treatments 9 to 13 were made on July 9 after larval counts and defoliation estimates were taken. Assessments were made by counting the number of CPB larvae and % defoliation on each of five plants per plot, on June 27, July 2, 9, 16, 23, and 30. Potatoes were harvested on September 24, and total yield in t/ha was calculated for each treatment. Results were analyzed using the Duncan's Multiple Range Test ($P \leq 0.05$).

RESULTS: Data are presented in Tables 1, 2, 3, and 4.

CONCLUSIONS: Early split applications of SPINOSAD 480SC (Treatments 4 to 6) were as effective as ADMIRE 240F in reducing larval populations and preventing defoliation (Tables 1 and 2). Late split applications of SPINOSAD 480SC (Treatments 9 to 11) were also as effective as ADMIRE 240F in reducing larval populations and preventing defoliation (Tables 3 and 4). In terms of actual percent defoliation, the data indicates that an early split application of SPINOSAD 480SC would be more advantageous to growers. None of the early (Table 1) or late (Table 3) applications of SPINOSAD 480SC had significantly different yields compared to ADMIRE 240F and RIPCORD 400EC. Yields were substantially lower than growers' standards in all treatments due to identified ozone damage to plants which occurred early in the growing season.

Table 1. Treatment comparison of early applications of SPINOSAD 480SC.

Tr #	Treatment Description	# larvae July 2 (Day 7)	July 9 (Day 14)	July 16 (Day 21)	July 23 (Day 28)	Yield t/ha
1	Untreated Check	24.65a	21.90a	12.40a	3.25bcd	7.16b
2	Spinosad 40 g AI/ha (30% Egg Hatch)	0.45b	2.10b	3.75bc	12.60a	10.13ab
3	Spinosad 80 g AI/ha (30% Egg Hatch)	3.25b	0.40b	2.85bc	8.80ab	11.94a
4	Spinosad 40 + 40 g AI/ha (30% Egg)	0.60b	1.00b	3.15bc	2.85bcd	10.28ab
5	Spinosad 80 + 80 g AI/ha (30% Egg)	0.45b	0.00b	0.10c	1.10cd	11.98a
6	Spinosad 80 + 40 g AI/ha (30% Egg)	0.00b	1.05b	2.30bc	3.25bcd	11.22ab
12	Ripcord 35 g AI/ha	9.50b	18.15a	6.00b	7.15abc	11.54a
13	Admire 0.2 L prod/ha	3.40b	0.00b	1.85bc	6.55bcd	11.00a

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$ Duncan's New MRT).

Table 2. Treatment comparison of early applications of SPINOSAD 480SC.

Tr #	Treatment Description	% defoliation July 2 (Day 7)	July 9 (Day 14)	July 16 (Day 21)	July 23 (Day 28)
1	Untreated Check	5.50cd	13.75bcd	30.50b	33.75a
2	Spinosad 40 g AI/ha (30% Egg Hatch)	3.50cd	5.50d	7.50c	9.25b
3	Spinosad 80 g AI/ha (30% Egg Hatch)	2.50d	4.50d	4.00c	8.25b
4	Spinosad 40 + 40 g AI/ha (30% Egg)	0.80d	4.75d	5.25c	5.75b
5	Spinosad 80 + 80 g AI/ha (30% Egg)	2.75d	3.00d	1.00c	2.75b
6	Spinosad 80 + 40 g AI/ha (30% Egg)	3.50cd	3.50d	3.75c	7.50b
12	Ripcord 35 g AI/ha	4.75cd	18.75abc	46.50a	25.75a
13	Admire 0.2 L prod/ha	1.50d	3.00d	2.00c	4.50b

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$ Duncan's New MRT).

Table 3. Treatment comparison of late applications of SPINOSAD 480SC.

Tr #	Treatment Description	# larvae July 9 (Day 7)	July 16 (Day 14)	July 23 (Day 21)	July 30 (Day 28)	Yield t/ha
1	Untreated Check	21.90a	12.40a	3.25bcd	0.80bc	7.16b
7	Spinosad 40 g AI/ha (50% Egg Hatch)	2.50b	2.45bc	4.40bcd	5.50ab	10.13ab
8	Spinosad 80 g AI/ha (50% Egg Hatch)	1.80b	0.95bc	4.45bcd	4.65abc	9.74ab
9	Spinosad 40 + 40 g AI/ha (50% Egg)	1.10b	0.00c	0.40d	0.05c	10.92ab
10	Spinosad 80 + 80 g AI/ha (50% Egg)	0.30b	0.50c	0.25d	0.75bc	11.61a
11	Spinosad 80 + 40 g AI/ha (50% Egg)	0.20b	0.00c	0.20d	0.75bc	10.73ab
12	Ripcord 35 g AI/ha	18.15a	6.00b	7.15abc	0.90bc	11.54a
13	Admire 0.2 L prod/ha	0.00b	1.85bc	6.55bcd	5.60ab	11.00a

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$ Duncan's New (MRT).

Table 4. Treatment comparison of late applications of SPINOSAD 480SC.

Tr #	Treatment Description	% defoliation July 9 (Day 7)	July 16 (Day 14)	July 23 (Day 21)	July 30 (Day 28)
1	Untreated Check	13.75bcd	30.50b	33.75a	39.25a
7	Spinosad 40 g AI/ha (50% Egg Hatch)	11.00bcd	5.00c	7.75b	11.75b
8	Spinosad 80 g AI/ha (50% Egg Hatch)	22.00ab	6.00c	7.75b	10.75b
9	Spinosad 40 + 40 g AI/ha (50% Egg)	8.00cd	3.75c	4.75b	7.00b
10	Spinosad 80 + 80 g AI/ha (50% Egg)	10.00cd	9.00c	4.50b	6.75b
11	Spinosad 80 + 40 g AI/ha (50% Egg)	26.75a	9.25c	8.00b	8.50b
12	Ripcord 35 g AI/ha	18.75abc	46.50a	25.75a	17.50b
13	Admire 0.2 L prod/ha	3.00d	2.00c	4.50b	11.50b

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$ Duncan's New MRT).

PMR REPORT # 43 **SECTION C: INSECT PESTS OF POTATOES**
STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: TEST OF AN IN-GROUND TRENCH OR AN ABOVE-GROUND TRAP VS CONVENTIONAL TREATMENT FOR COLORADO POTATO BEETLE CONTROL ON POTATOES

MATERIALS: NOVODOR 3% (*Bacillus thuringiensis* var.*tenebrionis),* ADMIRE 240 F (imidacloprid)

METHODS: Small, whole potatoes were planted at Harrington, P.E.I. on May 24, 1997. Plants were established in four-row plots with a spacing of about 0.4 m within rows and about 0.9 m between rows. The plots, measuring 7.6 m in length and 3.6 m in width, were arranged in a randomized complete block design with three contiguous replications and four treatments. The in-ground plastic-lined (1.1 mm plastic) trenches (Trench) or surface-mounted polyethylene traps (Trap) were installed on one side of the potato rows, while two buffer rows of Superior potatoes treated in-furrow with ADMIRE were planted on the other side, between the plots and the rest of the field, to inhibit movement of insects into the plots from the back or from the sides. Plots and barriers were separated from each other by 23 cm high vertical pieces of steel flashing set up at right angles to the rows. On July 8, twenty-five colour-coded CPB adults were released in front of each plot, either on the ground in front of the barriers or in the same position in the plots lacking barriers. For the next three days and on the seventh day, all plants in each plot were examined to determine the number of marked insects which had successfully entered the plots. Subsequently, whole-plant counts of CPB spring adults, early (L1/L2) and late (L3/L4) larvae, and summer adults were carried out on ten plants per plot from July 15 until August 25. Weekly defoliation ratings were done from July 18 until August 29. When a threshold of 2.0 Colorado Potato Beetle Equivalents (CPBE) per plant was exceeded , a foliar spray of NOVODOR at 8.0 L prod./ha was applied on August 15 to the foliar-spray treatment using a tractor-mounted precision plot sprayer at 240 kPa and 303 L H_2O/ha. The multiplication of spring adults by 1.0, L1/L2 larvae by 0.125, L3/L4 larvae by 0.333, and summer adults by 0.625 converts each growth stage to its CPBE. Diquat was applied at the rate of 370 g AI/ha to the entire experiment on September 2 for top desiccation. Weeds were controlled with an application of metribuzin at 1.1 kg AI/ha on June 12. Plots received recommended applications of chlorothalonil at 1.25 kg AI/ha, and copper hydroxide at the same rate, plus mancozeb at 1.6 kg AI/ha and propomocarb at 1.6 l AI/ha, for control of late blight. Tubers from the center two rows of each plot were harvested on September 16, and total and marketable (dia.>38 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln(x+1) before analysis. Percent defoliation was transformed to sqrt(arcsine(prop)) before analysis. Detransformed means are presented.

RESULTS: Results are summarized in the tables below.

CONCLUSIONS: Fewer marked adults were recovered on potato plants one, three and seven days after release in plots protected by a trench or a trap than on plants of the other two treatments tested (Table 1). While fewer CPBE were observed on plants in plots that had a barrier to restrict the movement of the CPB, this trend was not significant and did not persist throughout the season (Table 2). A trench or trap barrier reduced the level of defoliation relative to the Check and NOVODOR. The application of NOVODOR was too late to effectively manage the CPB. Yields among treatments were not statistically different. Weights averaged over the four treatments were 29.2 t/ha for marketable tubers and 30.5 t/ha for total tubers.

Table 1. Recovery of marked CPB adults in a trench/trap or on plants one, three and seven days after the release of 25 adults per treatment.

Treatment	-------------------------Average no. of CPB adults found*------------------------					
	Day 1		Day 3		Day 7	
	Trench	On Plants	Trench	On Plants	Trench	On Plants
Check	N/A	5.8	N/A	6.0a	N/A	2.7
Plastic-lined dug trench	2.3	0.7	3	0.7c	0.7	0.7
Plastic trap	2	0.7	1.3	2.3b	1.3	0.7
Foliar spray	N/A	7.3	N/A	5.0ab	N/A	1.7
ANOVA ($P \leq 0.05$)	ns	ns	ns	----	ns	ns

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. A comparison of the effectiveness of different control tactics for the Colorado potato beetle on potatoes, P.E.I., 1997.

Treatment	-------Mean No./Plant - CPBE------				-----------% Defoliation**-----------			
	July 15	-----August----- 5	11	season average	July 25	-----August----- 15	29	season average
Check	0.6*	0.91	1.98	1.03	1.7	10.5	10.5	5.8
Trench	0	0.71	2.14	0.95	0.4	5.7	9	4.1
Trap	0.3	0.71	1.34	0.87	0.5	7	8.2	4.1
Foliar sprays	0.2	1.59	2.71	1.21	1	10.3	10.3	5.8
ANOVA ($P \leq 0.05$)	ns	ns	ns	ns	ns	ns	ns	ns

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P \leq 0.05$).

** The data were transformed to the sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

PMR REPORT # 44

SECTION C: INSECT PESTS OF POTATOES
STUDY DATA BASE: 303-1452-8702

CROP:	Potato, cv. Shepody
PEST:	Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say) Potato flea beetle (PFB), *Epitrix cucumeris* (Harr.) Tarnished plant bug (TPB), *Lygus lineolaris* P. de Beauvois Potato aphid (PA), *Macrosiphum euphorbiae* (Thos.)

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TITLE: COMPARISON OF FIPRONIL AND ADMIRE FOR EFFICACY AND RESIDUAL ACTIVITY AGAINST POTATO INSECT PESTS

MATERIALS: FIPRONIL (EXP60145A), ADMIRE 240 FS (imidacloprid)

METHODS: Cut seed potato pieces were planted in Harrington, P.E.I., on May 28, 1997. Plants were established in four-row plots, spaced at about 0.4 m within rows and about 0.9 m between rows. The plots, measuring 15.2 m in length and 3.6 m in width, were separated from each other by two buffer rows of potatoes. Plots were arranged in a randomized complete block design, with five treatments each replicated four times. Treatments were applied as foliar sprays using a CO_2-pressurized precision plot sprayer at 240 kPa and 303 L H_2O/ha. Spray thresholds of either 1-2 adults per plot or 16-20 small larvae (L1/L2) with some large larvae (L3-L4) per plot were used. The treatments were as follows: 1) Check, 2) Adult Threshold, FIPRONIL at 25 g AI/ha, 3) Adult Threshold, ADMIRE at 50 g AI/ha, 4) Larval Threshold, FIPRONIL at 25 g AI/ha, and 5) ADMIRE at 50 g AI/ha. Treatments for the Adult Threshold were applied on July 14 and August 26, and treatments for the Larval Threshold were applied on July 22. The numbers of plants counted per plot in each sample date were 15 plants for the pre-spray and 1, 3, and 7 days post-spray counts; 10 plants for the 10 and 14 post-spray counts; and 5 plants for 21 days post-spray. Counts of CPB egg masses, early instars, late instars, and adults were made on a whole plant basis. Population levels of potato flea beetles, tarnished plant bugs, and potato aphids were made using 10 net sweeps (0.4 m dia.) per plot. Percent defoliation was recorded weekly from July 18 to September 18. After planting, plots received a pre-emergence application of metribuzin at 1.1 kg AI/ha for weed control. On July 25, the buffer rows were sprayed with spinosyn A/D at 80 g AI/ha to keep insects from moving between plots. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha and copper hydroxide at the same rate, plus mancozeb at 1.6 kg AI/ha for late blight control. Diquat was applied at the rate of 370 g AI/ha on September 18 for top desiccation. Tubers from the centre two rows of each plot were harvested on October 3, and total and marketable (dia.>38 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Detransformed means are presented.

RESULTS: Results are summarized in Tables 1 - 6 that follow.

CONCLUSIONS: Fewer early instars were observed in plots treated with FIPRONIL or ADMIRE relative to the Check (Table 1). With the exception of the Adult Threshold on July 21 , the efficacies of FIPRONIL and ADMIRE were similar. The eight-day delay in the application of insecticides using the Larval Threshold rather than the Adults Threshold did not adversely affect the seasonal average for early instars relative to the Check (Table 1). An application of FIPRONIL or ADMIRE on July 14 significantly reduced late instars until August 13 (Table 2). The application on July 22 for the Larval Threshold was effective until August 19. Although not always statistically significant, there was a tendency for fewer late instars in plots treated with ADMIRE relative to plots protected with FIPRONIL, however, the seasonal averages for both products were similar and significantly lower than the Check (Table 2). The lack of abundance in overwintered adults precluded any comparisons of products and thresholds (Table 3). Fewer summer adults were noted on plots treated with either FIPRONIL or ADMIRE from August 13 until September 5 (Table 3). No statistical differences were noted among plots treated with FIPRONIL or ADMIRE but these treatments supported fewer adults than the Check. Both FIPRONIL and ADMIRE significantly reduced defoliation in plots. Although plants in the Check plots suffered up to 51% defoliation, the seasonal average defoliation in the treated plots was 4.8% or less (Table 4). Managing CPB populations with the Adult or the Larval Threshold resulted in higher tuber yields compared to the untreated Check (Table 4). The July 14 (Adult Threshold) application of FIPRONIL or ADMIRE reduced populations of the PFB from July 15 until July 21 (Table 5). The application on July 22 for the Larval Threshold was too late to have an impact on the PFB adults (data not shown). No efficacy was noted later in the growing season. ADMIRE did reduce PA populations on September 3 and 9 whereas FIPRONIL did not (Table 5). The second application of ADMIRE on August 26 significantly reduced aphid populations relative to the single application of ADMIRE earlier in the growing season (Table 5). Consequently, only plots treated with ADMIRE twice during the growing season had significantly fewer aphids than the Check (Table 5). Although the data were inconsistent with respect to efficacy, two applications of FIPRONIL or ADMIRE, or a single application of ADMIRE reduced tarnished plant bug populations relative the Check (Table 6).

Table 1. Management of the CPB with an adult or a larval threshold, Harrington, P.E.I., 1997.

	Mean No. Early Instars/Plant								
	--------------July--------------			------------------August-------------------				Sept.	
Treat.	14th	21th	29th	7th	13th	19th	29th	5th	Avg.
1	11.3*	11.1a	7.8a	7.0a	1.9a	1	0	0	5.23a
2	8.4	1.3b	1.1b	4.1ab	2.5a	1	0	0	1.76b
3	12.9	0.1c	1.0b	2.3bc	3.3a	0.6	0.9	0	1.87b
4	8.6	9.3a	1.4b	1.0cd	0.1b	0	0	0	3.05b
5	8.3	15.2a	0.9b	0.3d	0.2b	0.3	0.2	0	3.02b

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P<0.05).

Table 2. Management of the CPB with an adult or a larval threshold, Harrington, P.E.I., 1997.

Mean No. Later Instars/Plant

	--------------July--------------			------------------August------------------				Sept.	
Treat.	14th	21th	29th	7th	13th	19th	29th	5th	Avg.
1	0.0*	4.5a	6.4a	9.8b	10.7a	4.6a	0.2	0.1	3.33a
2	0.4	0.2b	1.4b	1.3b	3.1b	2.7a	0	0	0.69b
3	0	0.1b	0.2c	1.0bc	2.4b	4.3a	1	0	0.57b
4	0	3.7a	0.1c	0.7bc	1.1bc	0.2b	0.1	0	0.41b
5	0.3	3.4a	0.1c	0.3c	0.6b	0.2b	0	0	0.40b

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

Table 3. Management of the CPB with an adult or a larval threshold, Harrington, P.E.I., 1997.

Mean No. Adult/Plant

	-------------July-------------			------------------August---------------				---September---		
Treat.	14th	21th	29th	7th	13th	19th	29th	5th	16th	Avg.
1	0.4	0.2	0.1ab	0	1.1a	4.1a	4.5a	4.7a	1.4a	1.88a
2	0.4	0	0.1a	0	0.1b	0.4bc	0.5b	0.5c	0.4b	0.32b
3	0.3	0	0.1ab	0	0.1b	0.1c	0.5b	1.7b	1.8a	0.53b
4	0.5	0.1	0.0b	0	0.2b	0.4bc	0.8b	1.1bc	0.5b	0.48b
5	0.4	0.1	0.0b	0.2	0.3b	0.5b	1.1b	1.9b	1.0ab	0.60

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

Table 4. Management of the CPB with an adult or a larval threshold, Harrington, P.E.I., 1997.

	Defoliation (%)							
	--July--	--------August-------		-----September-----			-------Yield-------	
Treat.	18th	8th	29th	5th	11th	Avg.	Total (t/ha)	Marketable (t/ha)
1	1.5*	17.4a	30.3a	49.5a	51.0a	25.5a	33.04b	31.93b
2	0.6	3.0b	5.1b	8.0bc	8.3b	4.8b	35.79a	34.78a
3	0.4	0.9b	4.1b	11.8b	7.3bc	4.3b	36.35a	35.39a
4	1.5	1.5b	2.4b	4.8c	7.6bc	3.4b	36.48a	35.40a
5	1.4	1.0b	2.4b	6.4bc	6.0c	3.2b	36.34a	35.44a

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

Table 5. Management of PFB and aphids using adult or a larval threshold of the CPB, Harrington, P.E.I., 1997.

	---------------PFB / 10 sweeps-----------				------------Aphids / 10 sweeps------------				
	---------------------July---------------------				-------August------		----September----		
Treat.	14th	15th	17th	21th	19th	27th	3th	9th	Avg.
1	49.5*	19.8a	52.8a	17.8a	40.5	101.3	77.5a	180.0a	46.2a
2	53.3	9.5b	5.8b	7.0b	38.8	109	115.7a	171.8a	52.4a
3	36	3.3c	9.0b	8.5ab	35.8	81.8	23.3c	3.3c	15.4b
4	51	12.8ab	34.8a	12.3ab	59.5	104.8	101.0ab	168.8a	51.9a
5	38	16.3ab	50.8a	15.3a	33.8	79.3	49.0b	70.8b	25.7ab

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

Table 6. Management of Tarnish Plant Bugs using an adult or a larval threshold of the CPB, Harrington, P.E.I., 1997.

	-----August----	----------------------September----------------------			
Treat.	27th	3rd	9th	16th	Avg.
1	1.0*	8.0a	15.5ab	27.0a	4.92
2	0.5	4.0a	7.3c	15.0bc	2.85
3	0.8	1.0b	10.0b	9.3c	2.37
4	0.5	5.5a	15.8a	20.8ab	4.13
5	0.5	5.0a	8.0c	14.5bc	2.8

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

PMR REPORT # 45 **SECTION C: INSECT PESTS OF POTATOES**
STUDY DATA BASE #: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: A COMPARISON OF B.T.T. FORMULATIONS FOR CONTROL OF COLORADO POTATO BEETLE ON POTATO

MATERIALS: ABG-6444 FC, ABG-6445 FC, ABG-6472 FC AND ABG-6473 FC (*Bacillus thuringiensis var. tenebrionis*), ADMIRE 240 FS (imidacloprid)

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island, on May 24, 1997, in 4-row plots with plants spaced at 0.4 m within rows and 0.9 m between rows. Plots were 7.6 m long and 3.6 m wide, and were separated from each other by two buffer rows of potatoes. They were arranged in a randomized complete block design with ten treatments and four replications. Treatments were applied as foliar sprays, at 303 L/ha and a pressure of approximately 240 kPa, using a CO_2-pressurized precision-plot sprayer. Initial spays were timed to coincide with first hatch of the CPB egg masses (July 6). Additional sprays were applied six days later on July 12. Due to the presence of small larvae, the sprays were applied on August 8 and six days later on August 13. Each week, from July 10 to August 26, the numbers of early instars (L1-L2), late instars (L3-L4), and adults of the CPB were counted from 10 plants from the center 2 rows of each plot. A Colorado Potato Beetle Equivalent (CPBE) is a summation of all damaging growth stages of the CPB observed each week or over the growing season. The number of CPBE's are calculated using the formula: CPBE = [(spring adults x 1) + (early instars x 0.125) + (late instars x 0.333) + (summer adults x 0.625)]. Percent defoliation was recorded weekly from July 18 to August 29. To prevent interplot movement of CPB, an application of aryl heterocycle (FIPRONIL) was made to buffer rows on July 25. Weeds were controlled with an application of metribuzin at 1.1 kg AI/ha on June 12. Plots received recommended applications of chlorothalonil at 1.25 kg AI/ha, and copper hydroxide at the same rate, plus mancozeb at 1.6 kg AI/ha and propomocarb at 1.6 l AI/ha, for control of late blight. All plots were sprayed with diquat at 370 g AI/ha on September 2 for top desiccation. Tubers from the center 2 rows of each plot were harvested on September 15 and 16, and total and marketable (>38 mm dia.) tuber weights were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln (x + 1) and percent defoliation was transformed to sqrt (arcsine (prop)) before analyses. The detransformed means are presented.

RESULTS: Results are summarized in Tables 1-4 that follow.

CONCLUSIONS: Seasonal averages for each growth stage are good indicators of the effectiveness of products. Early instars were controlled with the higher rates of ABG-6473 and both rates of the ABG-6472 and 6445 formulations (Table 1). Although not always statistically significant, a rate response was observed for all formulations tested (Table 1). Similar trends were noted for later instars (Table 2) and for CPBE (Table 3). Defoliation in Check plots peaked at about 25% on August 22 (Table 4). Defoliation in all treated plots did not exceed 7.6%. Plots treated with the higher rate of each formulation tended to suffer less defoliation than the corresponding plots treated with the lower application rate (Table 4). Few early and late instars, and CPBE were observed on plots treated with ADMIRE. Marketable tuber yields averaged 34.9 t/ha. No significant differences among treatments were noted with respect to yields. No phytotoxicity was observed in any of the plots.

Table 1. A comparison of the efficacy of two rates of four formulations of a B.t.t. insecticide and of ADMIRE against early instars (L1-L2) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1997.

Treatment	Rate (L/prod/ha)	Mean number of CPB early instars (L1-L2)/plant					
		35985	35991	35998	36005	Aug. 26	season average
Check		2.1	3.7a*	5.1a	1.1abc	0.1	2.3ab
ABG-6444 FC	4.7 L	5.3	1.5abc	2.6ab	1.8a	0.2	2.8a
ABG-6444 FC	7.0 L	1.9	1.6abc	1.2bcd	0.5bc	0.1	1.4bcd
ABG-6473 FC	4.7 L	1.3	2.6ab	4.1a	1.7ab	0.2	1.7bc
ABG-6473 FC	7.0 L	0.4	0.3cd	1.1bcd	0.2c	0.1	0.5efg
ABG-6472 FC	4.7 L	1.2	0.9bcd	1.6abc	0.4bc	0.1	1.1cde
ABG-6472 FC	7.0 L	2.1	0.5cd	0.6cd	0.4bc	0.2	0.7ef
ABG-6445 FC	4.7 L	1.6	0.9bcd	1.0bcd	0.1c	0.3	1.0def
ABG-6445 FC	7.0 L	0.2	0.4cd	0.7cd	0.3c	0.1	0.4fg
ADMIRE 240 FS	0.2 L	0	0.0d	0.0d	0.0c	0	0.3g
ANOVA $P \leq 0.05$		ns	----	----	----	ns	----

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. A comparison of the efficacy of two rates of four formulations of a B.t.t. insecticide and of ADMIRE against late instars (L3-L4) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1997.

Treatment	Rate (L/prod/ha)	Mean number of CPB late instars (L3-L4)/plant					
		35991	35998	Aug. 6	Aug. 12	Aug. 19	season average
Check		1.5a*	4.2a	1.6ab	2.1ab	2.4a	1.8a
ABG-6444 FC	4.7 L	0.0b	1.2bc	1.8a	4.8a	1.9ab	1.5ab
ABG-6444 FC	7.0 L	0.0b	0.2cd	0.6bc	0.8abcd	0.5c	0.5cd
ABG-6473 FC	4.7 L	0.0b	1.7ab	1.0abc	1.5abc	1.6ab	1.0b
ABG-6473 FC	7.0 L	0.0b	1.3abc	0.7bc	2.7ab	0.7bc	0.8bc
ABG-6472 FC	4.7 L	0.0b	0.4bcd	0.2c	0.5cd	0.5bc	0.3de
ABG-6472 FC	7.0 L	0.0b	0.3cd	0.1c	0.4cd	0.3c	0.2de
ABG-6445 FC	4.7 L	0.0b	0.4bcd	0.3c	0.7bcd	0.6bc	0.4cd
ABG-6445 FC	7.0 L	0.0b	0.4bcd	0.5c	0.2cd	0.2c	0.2de
ADMIRE 240 FS	0.2 L	0.0b	0.0d	0.1c	0.0d	0.0c	0

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 3. A comparison of the efficacy of two rates of four formulations of a B.t.t. insecticide and of ADMIRE against the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1997.

Treatment	Rate (L prod/ha)	Mean number of CPBE/plant						
		35991	35998	Aug. 6	Aug. 12	Aug. 19	Aug. 26	season average
Check		0.99a*	2.02a	1.26ab	2.07a	2.57a	1.88a	1.51a
ABG-6444 FC	4.7 L	0.26bcd	0.81bc	1.52a	2.09ab	1.45b	1.36a	1.11b
ABG-6444 FC	7.0 L	0.27bc	0.27cd	0.61bc	0.59bcd	0.69bc	0.93ab	0.52c
ABG-6473 FC	4.7 L	0.35b	1.19ab	0.57bc	0.90abc	1.23b	1.29a	0.80b
ABG-6473 FC	7.0 L	0.06cd	0.60bcd	0.33c	1.06abc	0.77bc	1.00ab	0.53cd
ABG-6472 FC	4.7 L	0.11bcd	0.37cd	0.45c	0.30cd	0.33cd	0.40bc	0.29de
ABG-6472 FC	7.0 L	0.12bcd	0.16d	0.15c	0.28cd	0.27cd	0.34bc	0.22ef
ABG-6445 FC	4.7 L	0.11bcd	0.29cd	0.37c	0.42cd	0.72bc	0.39bc	0.35cde
ABG-6445 FC	7.0 L	0.05cd	0.26cd	0.28c	0.13cd	0.16d	0.30bc	0.19ef
ADMIRE 240 FS	0.2 L	0.00d	0.13d	0.26c	0.03d	0.04d	0.10c	0.07f

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 4. Percent defoliation of potato plots protected with B.t.t.. or ADMIRE insecticides for the management of the Colorado potato beetle, Harrington, P.E.I., 1997.

Treatment	Rate (L/prod/ha)	Percent Defoliation**					
		July 25	Aug 1	Aug 8	Aug 15	Aug 22	Aug 29
Check		3.4a*	3.5a	8.3a	19.6a	24.6a	24.6a
ABG-6444 FC	4.7 L	0.7cde	2.0abc	3.0bc	4.5b	5.8bc	7.4b
ABG-6444 FC	7.0 L	0.5de	1.4bc	1.5cd	3.0bc	3.4c	3.4bc
ABG-6473 FC	4.7 L	1.9b	2.4ab	3.4b	4.8b	7.6b	7.6b
ABG-6473 FC	7.0 L	1.4bc	1.8abc	1.5cd	3.8bc	4.8bc	4.8bc
ABG-6472 FC	4.7 L	0.8bcd	1.3bc	2.0bcd	4.5b	4.5bc	4.5bc
ABG-6472 FC	7.0 L	0.1ef	0.6c	1.0d	3.0bc	3.0c	3.4bc
ABG-6445 FC	4.7 L	0.4de	1.4bc	1.5cd	2.5c	3.0c	3.8bc
ABG-6445 FC	7.0 L	0.4de	0.8bc	1.0d	2.5c	3.0c	3.0c
ADMIRE 240 FS	0.2 L	0.0f	0.0d	0.2e	0.5d	0.5d	0.5d

[*] Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

[**] The data were transformed to the sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

PMR REPORT # 46 **SECTION C: INSECT PESTS OF POTATOES**
ICAR/IRAC: 86100104

CROP: Potato, cv. Shepody
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: COMPARING A SINGLE APPLICATION OF FIPRONIL TO ADMIRE IN THE CONTROL OF COLORADO POTATO BEETLE (CPB) ADULTS AND LARVAE, 1997

MATERIALS: FIPRONIL (EXP60145A) 25 g AI/ha, and ADMIRE (imidacloprid) 50 g AI/ha

METHODS: Potatoes were planted on May 13, in 4-row plots, 13 m long, replicated four times. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. Insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. The treatment targeting adults was applied on June 26. The larval spray was applied on July 2. Populations of CPB were monitored by counting the number of larvae and/or adults per 20 plants per plot, pre-spray, and approximately 1, 3, 7, 10, 14, and 21 days after treatment. Tubers were harvested September 4.

RESULTS: Data are presented in Table 1.

CONCLUSIONS: Colorado potato beetle adults, and small and large larvae, were controlled with a single application of FIPRONIL and ADMIRE. The larvae were controlled for 14 days and the overwintering and summer adults were controlled after the initial treatment. Yields were significantly higher in all treated plots when compared to the CHECK except for the ADMIRE treatment targeting adults. A single application of FIPRONIL equaled the control given by a single application of ADMIRE.

Table 1. A comparison of the effects of a single application of FIPRONIL vs ADMIRE on populations of CPB on potatoes, Cambridge, 1997.

Insecticide		Numbers of adults, small and large larvae per 20 plants							Yield
		Pre	1 day	3 day	6 day	9 day	14 day	21 day	t/ha
FIPRONIL	Adult	9.3a	0.0a	0.0a	0.3a	0.0a	0.0a	2.0a	10.7a
ADMIRE	Adult	11.8a	0.3a	0.0a	1.0a	0.0a	1.3a	1.0a	7.2b
FIPRONIL	Small larvae	245.0a	3.5a	0.8a	0.0a	0.3a	0.0a	0.3a	12.7a
	Large larvae	0.0a	0.0a	0.3a	0.0a	0.0a	3.3a	10.5a	
ADMIRE	Small larvae	233.0a	39.3a	12.3a	0.3a	0.5a	1.8a	8.5a	10.6a
	Large larvae	0.0a	1.8a	0.3a	0.5a	0.0a	1.5a	11.3a	
CONTROL	Adult	10.0a	6.5b	4.3b	2.8b	0.8a	0.3a	31.0b	5.2b
	Small larvae	263.3a	192.5b	115.0b	126.3b	71.3b	42.0b	2.8a	
	Large larvae	0.0a	81.3b	142.5b	190.0b	200.0b	141.5b	44.8a	

* Means in each column followed by the same letter are not significantly different at $P \leq 0.05$ (Tukey's Studentized Range Test).

PMR REPORT # 47 **SECTION C: INSECT PESTS OF POTATOES**
ICAR/IRAC: 86100104

CROP: Potato, cv. Shepody
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: EFFECTS OF VARIOUS RATES OF DIFFERENT NOVODOR FORMULATIONS (*BACILLUS THURINGIENSIS TENEBRIONIS*), COMPARED TO ADMIRE FOR THE CONTROL OF COLORADO POTATO BEETLE (CPB), 1997

MATERIALS: ABG 6444, ABG 6445, ABG 6472, ABG 6473 (*Bacillus thuringiensis* var. *tenebrionis*), and ADMIRE 240 FS (imidacloprid)

METHODS: Potatoes were planted on May 13, in four-row plots, 13 m long, replicated four times. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. Insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. One hundred CPB egg masses were flagged on June 20 and checked daily to determine hatch. By June 23, 30% of the egg masses had hatched. The initial spray of all treatments was applied on June 23. There was in excess of 20 mm of rain within three hours of completing this spray and therefore all treatments were re-applied on June 25. An additional spray against the first generation of CPB was applied to all treatments on July 4. Populations of CPB were monitored three days after the initial spray and weekly thereafter. Counts were taken by examining five plants in each plot and the numbers of larvae and adults were recorded. The percent defoliation caused by adults and larvae was estimated. Tubers were harvested September 4.

RESULTS: Data are presented in Tables 1 and 2.

CONCLUSIONS: After a single application, all treatments significantly reduced the amount of defoliation and the development of large larvae, but the number of small larvae was not reduced when compared to the untreated Check. A second application on July 4 reduced larval counts and defoliation damage in all plots through July 16, with the exception of the low rate of ABG 6473 where some small larvae persisted on July 7 (Tables 1 and 2). On July 23 the numbers of small larvae were still substantially lower in treatments using the high rate of ABG 6444, ABG 6445, and ABG 6472 (Table 1). All treatments produced higher yields when compared to the Check, but these yields were not statistically different in the high rates of ABG 6444, ABG 6472, ABG 6445, and the low rate of ABG 6473.

Table 1. A comparison of the effects of different rates of various formulations of NOVODOR and the standard ADMIRE on populations of CPB, Guelph, Ontario, 1997.

	Rate	Small larvae/Plant				Large larvae/Plant			
		---------------------July-------------------				---------------------July-------------------			
Insecticide	L/Prod/ ha	1	7	16	23	1	7	16	23
ABG-6444	4.5	3.2ab	3.0a	0.1a	1.8ab	0.0a	0.3a	0.2a	4.6bc
ABG-6444	6.8	2.4ab	0.9a	0.0a	0.1a	0.0a	0.0a	0.0a	0.7ab
ABG-6472	4.5	6.2ab	3.3a	0.1a	0.6ab	0.0a	0.3a	0.1a	0.8ab
ABG-6472	6.8	12.4b	0.3a	0.1a	0.0a	0.1a	0.1a	0.0a	0.5ab
ABG-6473	4.5	5.4ab	3.5ab	0.3a	0.9ab	0.1a	0.9a	1.9a	7.8c
ABG-6473	6.8	7.6ab	1.8a	0.3a	1.1ab	0.0a	0.5a	0.4a	4.2abc
ABG-6445	4.5	0.3a	2.0a	0.6a	1.2ab	0.0a	2.2a	0.4a	2.8ab
ABG-6445	6.8	5.3ab	2.0a	0.0a	0.1a	0.0a	0.1a	0.0a	1.4ab
ADMIRE (foliar)	50.0**	0.1a	0.0a	0.0a	0.5ab	0.0a	0.0a	0.0a	0.2a
Unsprayed check		7.3ab	9.7b	2.6b	2.5b	3.1b	13.2b	12.0b	4.7bc

* Means in each column followed by the same letter are not significantly different at $P \leq 0.05$ (Tukey's Studentized Range Test).

** g AI/ha

Table 2. A comparison of the effects of different rates of various formulations of NOVODOR and the standard ADMIRE on defoliation and yield of potatoes, Guelph, Ontario, 1997.

	Rate	Percent Defoliation				Yield
Insecticide	L/Prod/ha	35976	35617	35626	July 23	(t/ha)
ABG-6444	4.5	2.8a	1.6a	2.4a	5.3a	16.2ab
ABG-6444	6.8	2.4a	2.4a	2.1a	2.9a	15.9abc
ABG-6472	4.5	1.6a	2.8a	3.5a	2.0a	18.0ab
ABG-6472	6.8	2.9a	1.0a	2.2a	2.6a	14.7abc
ABG-6473	4.5	4.1ab	3.5a	4.3a	8.5a	13.3bc
ABG-6473	6.8	1.7a	3.1a	3.8a	5.6a	16.3ab
ABG-6445	4.5	2.4a	3.8a	3.2a	5.1a	21.3a
ABG-6445	6.8	2.7a	2.1a	2.5a	2.5a	15.6abc
ADMIRE (foliar)	50.0**	1.7a	0.8a	1.8a	1.7a	17.7ab
Unsprayed check		6.0b	18.0b	39.5b	40.8b	8.1c

* Means in each column followed by the same letter are not significantly different at $P \leq 0.05$ (Tukey's Studentized Range Test).

** g AI/ha

PMR REPORT # 48 **SECTION C: INSECT PESTS OF POTATOES**
ICAR: 61006535

CROP: Potatoes, cv. Superior
PEST: Colorado Potato Beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato Leafhopper, *Empoasca fabae* (Harris)

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TITLE: COMPARISON OF NOVODOR FORMULATIONS FOR THE CONTROL OF COLORADO POTATO BEETLES

MATERIALS: ABG-6444, ABG-6445, ABG-6472, ABG-6473, formulations of NOVODOR (endotoxine-delta of *Bacillus thuringiensis* var. *tenebriones*), ADMIRE 240F (imidocloprid)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated three times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 7, 1997. Timing of the initial spray application was at 30% CPB egg hatch with subsequent sprays at intervals of approximately 10 days thereafter. The foliar applications were applied using a specialized small-plot research CO_2 sprayer with two-nozzled hand-held boom, applying 200 L/ha of spray mixture on June 17, 27 and July 8, and 18. Assessments were taken by counting the number of CPB larvae per plot on June 23, 27, 30, July 7 and 11 and by foliage damage ratings caused by CPB and leafhopper feeding damage on June 30 and July 22. Yields were taken on August 11. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Tables 1 and 2.

CONCLUSIONS: The level of Colorado potato beetle control was not as high as expected due presumably because the first application needed to be applied before 30% CPB egg hatch (Table 1). There was a noticeable rate effect for each of the ABG formulations. Considerable more foliage damage due to insect feeding by the CPB was noted in plots treated with ABG-6473 (Table 2). The foliar application of ADMIRE 240F was more effective in controlling Colorado potato beetle and leafhopper than any of the ABG formulations.

Table 1. Colorado potato beetle larval counts.

Treatments	Rate L Product/ha	Insect Counts/Plot				
		June 23	June 27	June 30	July 7	July 11
ABG-6444	5.6	34.3 ab*	212.7 a	93.7 bc	121.7 bc	48.3
ABG-6444	8.4	41.7 ab	159.0 ab	48.0 de	137.3 bc	36
ABG-6445	5.6	19.0 ab	121.3abc	32.0 ef	128.3 bc	73.3
ABG-6445	8.4	4.0 b	85.0 bc	24.7 ef	121.7 bc	36.7
ABG-6472	5.6	41.0 ab	186.7 ab	55.0 cde	105.0 cd	52.3
ABG-6472	8.4	14.3 ab	156.3 ab	26.0 ef	53.3 de	49
ABG-6473	5.6	58.3 ab	211.3 a	109.0 b	196.7 a	36.7
ABG-6473	8.4	55.7 ab	208.3 a	76.7bcd	173.3 ab	22
ADMIRE 240F	0.2	3.3 b	32.0 c	2.0 f	19.0 e	55
CONTROL		87.7 a	168.0 ab	320.3 a	145.0abc	20.7
ANOVA P• 0.05		s	s	s	s	ns
Coefficient of Variation (%)		114.4	41.0	29.5	25.7	

* These values are the means of three replications. Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 2. Foliar insect damage results and yields.

		Foliar Damage Ratings (0-10)[1]			
Treatments	Rate L Product/ha	Colorado Potato Beetles June 30	Colorado Potato Beetles July 22	Leafhoppers July 22	Yield kg/plot
ABG-6444	5.6	7.8 b*	8.0 ab	2.0 b	14.4
ABG-6444	8.4	7.8 b	8.0 ab	2.0 b	16
ABG-6445	5.6	8.2 b	6.7 b	2.0 b	15.9
ABG-6445	8.4	9.7 a	8.3 a	2.0 b	15.4
ABG-6472	5.6	8.3 b	8.0 ab	2.0 b	15.1
ABG-6472	8.4	8.5 ab	8.0 ab	2.0 b	15
ABG-6473	5.6	5.7 c	3.7 cd	2.0 b	13.1
ABG-6473	8.4	6.3 c	4.0 c	2.0 b	13.4
ADMIRE 240F	0.2	8.8 ab	8.3 a	8.0 a	15.9
CONTROL		4.0 d	2.3 d	2.0 b	13.1
ANOVA P• 0.05		s	s	s	ns
Coefficient of Variation (%)		8.9	12.7	3.2	

* These values are the means of three replications. Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Foliar Damage Ratings (0-10) - 0, no control, foliage severely damaged; 10, complete control.

PMR REPORT # 49 **SECTION C: POTATO INSECTS**
ICAR: 61006535

CROP: Potatoes, cv. Superior
PEST: Colorado Potato Beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato Leafhopper, *Empoasca fabae* (Harris)

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TITLE: TIMING COMPARISONS USING SPINOSAD FOR THE CONTROL OF COLORADO POTATO BEETLES IN POTATOES

MATERIALS: SPINOSAD (spinosyn, *Saccharopolyspora spinosa*), GUTHION 240SC (azinphos-methyl), ADMIRE 240F (imidocloprid).

METHODS: Potatoes were planted in three-row plots, 7 m in length with rows spaced 1 m apart, replicated three times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 13, 1997. Timing of the initial spray application was at 30% CPB egg hatch with subsequent sprays at intervals of approximately 10 days thereafter. The foliar applications were applied using a specialized small-plot research CO_2 sprayer with two-nozzled hand-held boom, applying 200 L/ha of spray mixture on June 17, 23 and July 8, as outlined in Tables 1 and 2. Assessments were taken by counting the number of CPB larvae per plot on June 23, 26, 30, July 7 and 11 and by foliage damage ratings caused by CPB and leafhopper feeding damage on June 30 and July 22. Yields were taken on August 11. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Tables 1and 2.

CONCLUSIONS: SPINOSAD provided excellent control of Colorado potato beetles regardless of the rate or timing of application (Table 1). CPB larvae control was improved when the initial spray application was made at the 30% timing versus waiting an additional five days until 50% egg hatch. Lower larvae numbers were counted at the higher rate of SPINOSAD, especially at the 30% egg hatch initial spray interval. Regardless of the initial spray 30% or 50%, by June 26 control of all SPINOSAD treatments were superior to GUTHION 240SC and equal to the foliar-applied ADMIRE 240F (Table 1). SPINOSAD however was ineffective in controlling potato leafhoppers (Table 2). ADMIRE 240F was slightly more effective than GUTHION 240SC. Yields were not significantly effected.

Table 1. Colorado potato beetle larval counts.

Treatments[1]	Rate ml Product/ha	Timing of Application	Insect Counts/Plot June 23	June 26	June 30	July 7	July 11
SPINOSAD 480SC; SPINOSAD 480SC	83.3 83.3	30% Egg Hatch 5 Days Later	28.3bcd *	4.0 b	31.7 c	96.7bcd	94.0 ab
SPINOSAD 480SC; SPINOSAD 480SC	166.7 166.7	30% Egg Hatch 5 Days Later	5.3 cd	0.0 b	2.3 c	128.7abc	61.0 bc
SPINOSAD 480SC; SPINOSAD 480SC; SPINOSAD 480SC	83.3 83.3 83.3	30% Egg Hatch 5 Days Later 2 Weeks Later	32.3 bcd	0.0 b	22.0 c	131.3abc	31.0 c
SPINOSAD 480SC; SPINOSAD 480SC; SPINOSAD 480SC	166.7 166.7 166.7	30% Egg Hatch 5 Days Later 2 Weeks Later	14.7 cd	0.0 b	2.0 c	34.7 cd	11.3 c
SPINOSAD 480SC; SPINOSAD 480SC; SPINOSAD 480SC	83.3 83.3 166.7	30% Egg Hatch 5 Days Later 2 Weeks Later	28.7 bcd	0.0 b	12.7 c	85.0bcd	16.3 c
SPINOSAD 480SC	83.3	50% Egg Hatch	94.0 a-d	0.3 b	6.0 c	56.7bcd	46.3 bc
SPINOSAD 480SC	166.7	50% Egg Hatch	75.0 a-d	0.3 b	0.7 c	60.3bcd	23.0 c
SPINOSAD 480SC; SPINOSAD 480SC	83.3 83.3	50% Egg Hatch 2 Weeks	65.3 a-d	0.3 b	8.7 c	141.7 ab	33.3 c
SPINOSAD 480SC; SPINOSAD 480SC	166.7 166.7	50% Egg	128.3 a	0.3 b	0.0 c	30.7 d	11.7 c
SPINOSAD 480SC; SPINOSAD 480SC	166.7 83.3	50% Egg Hatch 2 Weeks Later	120.0 ab	0.3 b	0.3 c	40.3 cd	10.3 c
GUTHION 240SC; GUTHION 240SC; GUTHION 240SC	1.500e+11	30% Egg Hatch 5 Days Later 2 Weeks Later	51.0 a-d	9.0 b	76.0 b	75.3bcd	24.7 c
ADMIRE 240F; ADMIRE 240F; ADMIRE 240F	200200200	30% Egg Hatch 5 Days Later 2 Weeks Later	0.3 d	0.0 b	13.7 c	2.0 d	2.0 c
CONTROL			99.3 abc	341.7 a	356.0 a	197.0 a	136.7 a
ANOVA P• 0.05			s	s	s	s	s
Coefficient of Variation (%)			84.9	36.9	62.9	60.5	78.2

* These values are the means of three replications. Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] a change of spray timing

Table 2. Foliar insect damage results and yields.

Treatments	Rate ml Product/ha	Timing of Application	Foliar Damage Ratings (0-10)[1]			Yield kg/plot
			Colorado Potato Beetles		Leafhopper	
			June 30	July 22	July 22	
SPINOSAD 480SC;	83.3	30% Egg Hatch				
SPINOSAD 480SC	83.3	5 Days Later	9.8 a*	9.0 a	2.0 c	19.7
SPINOSAD 480SC;	166.7	30% Egg Hatch				
SPINOSAD 480SC	166.7	5 Days Later	10.0 a	9.0 a	2.0 c	20.7
SPINOSAD 480SC;	83.3	30% Egg Hatch				
SPINOSAD 480SC;	83.3	5 Days Later				
SPINOSAD 480SC	83.3	2 Weeks Later	10.0 a	9.0 a	2.0 c	20.8
SPINOSAD 480SC;	166.7	30% Egg Hatch				
SPINOSAD 480SC;	166.7	5 Days Later				
SPINOSAD 480SC	166.7	2 Weeks Later	10.0 a	9.0 a	2.0 c	18.3
SPINOSAD 480SC;	83.3	30% Egg Hatch				
SPINOSAD 480SC;	83.3	5 Days Later				
SPINOSAD 480SC	166.7	2 Weeks Later	10.0 a	9.0a	2.0 c	22.6
SPINOSAD 480SC	83.3	50% Egg Hatch	10.0 a	8.7 b	2.0 c	21.4
SPINOSAD 480SC	166.7	50% Egg Hatch	10.0 a	9.0 a	2.0 c	20.9
SPINOSAD 480SC;	83.3	50% Egg Hatch				
SPINOSAD 480SC	83.3	2 Weeks Later	10.0 a	9.0 a	2.0 c	20.1
SPINOSAD 480SC;	166.7	50% Egg Hatch				
SPINOSAD 480SC	166.7	2 Weeks Later	10.0 a	9.0 a	2.0 c	21.6
SPINOSAD 480SC;	166.7	50% Egg Hatch				
SPINOSAD 480SC	83.3	2 Weeks Later	10.0 a	9.0 a	2.0 c	22.2
GUTHION 240SC;	1.500e	30% Egg Hatch				
GUTHION 240SC;	+11	5 Days Later				
GUTHION 240SC		2 Weeks Later	8.3 b	9.0 a	7.7 b	24.4
ADMIRE 240F;	200200200	30% Egg Hatch				
ADMIRE 240F;		5 Days Later				
ADMIRE 240F		2 Weeks Later	10.0 a	9.0 a	8.0 a	21.2
CONTROL			6.3 c	3.0 c	2.0 c	18.6
ANOVA P• 0.05			s	s	s	ns
Coefficient of Variation (%)			2.5	0.9	5.5	

* These values are the means of three replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Foliar Damage Ratings (0-10) - 0, no control, foliage severely damaged; 10, complete control.

PMR REPORT # 50 **SECTION C: POTATO INSECTS**

CROP: Potatoes, cv. Shepody
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EFFICACY OF VARIOUS RATES OF SPINOSAD 480SC AGAINST COLORADO POTATO BEETLE (CPB) LARVAE, COMPARED WITH ADMIRE 240F AND RIPCORD 400EC ON SANDY SOIL

MATERIALS: SPINOSAD 480SC (spinosyn, *Saccharopolyspora spinosa*), ADMIRE 240F (imidacoprid), RIPCORD 400EC (cypermethrin)

METHOD: Potato seed pieces were planted at the Cambridge Research Farm, on May 6, 1997, in 4 row plots, 14.0 m in length with a row spacing of 0.9 m. Treatments were replicated four times in a randomized complete block design. Plots were separated by 3.0 m spray lanes. Foliar insecticide applications were applied using a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. One hundred CPB egg masses were flagged on June 20 and checked daily to determine hatch. By June 23, 30% of the egg masses were hatched. The initial spray of all treatments was applied on June 23. There was an excess of 20 mm of rain within three hours of completing this spray resulting in the re-application of all treatments on June 25. Assessments were made by counting the number of CPB larvae and % defoliation on each of five plants per plot, on June 27, July 2, 9, and 16. Potatoes were harvested on September 24, and total yield in t/ha was calculated for each treatment. Results were analyzed using the Duncan's Multiple Range Test ($P \leq 0.05$).

RESULTS: Data are presented in Tables 1 and 2.

CONCLUSIONS: Up to 14 days post-application, all treatments provided effective control of CPB larvae compared to the untreated Check, with the three highest rates of SPINOSAD 480SC and ADMIRE 240F providing significantly better control. By day 21, none of the plants in the treated plots had significantly fewer larvae compared to the untreated check plot. RIPCORD 400EC was not as effective in reducing larval populations as SPINOSAD 480SC or ADMIRE 240F throughout the duration of the experiment. With the exception of day three, plants in all treated plots had significantly less defoliation than those in the untreated check plot. Up to 21 days post-application, the two highest rates of SPINOSAD 480SC and ADMIRE 240F provided significantly better foliage protection than the untreated Check, RIPCORD 400EC, and the other SPINOSAD 480SC treatments. There was no significant difference between the three highest rates of SPINOSAD 480SC and the tank mix application compared to RIPCORD 400EC and ADMIRE 240F.

Table 1. Treatment comparison of mean larval counts post-treatment and total yield data in t/ha on sandy soil.

Treatment	# larvae				Yield Data
	June 27 (Day 3)	July 2 (Day 7)	July 9 (Day 21)	July 16 (Day 21)	t/ha
Untreated Check	7.55a*	38.80a	42.95a	2.20b	1.47c
Spinosad 40 g AI/ha	0.05b	12.45bc	2.95c	5.00ab	4.96bc
Spinosad 60 g AI/ha	0.00b	2.00cd	0.80c	2.95b	6.52ab
Spinosad 80 g AI/ha	0.00b	2.60cd	1.05c	3.10b	7.77ab
Spinosad 160 g AI/ha	0.00b	1.75cd	0.05c	0.10b	5.73b
Spinosad 40 g AI/ha + Bravo 2.25 L prod/ha	0.00b	3.40cd	3.35c	8.80a	6.78ab
Ripcord 35 g AI/ha	0.00b	14.75b	20.85b	5.65ab	10.60a
Admire 0.2 L prod/ha	1.00b	0.05d	0.15c	0.35b	7.32ab

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$, Duncan's New MRT).

Table 2. Treatment comparison of percent defoliation post-treatment on sandy soil.

Treatment	% defoliation			
	June 27 (Day 3)	July 2 (Day 7)	July 9 (Day 21)	July 16 (Day 21)
Untreated Check	5.00a*	14.75a	41.75a	95.25a
Spinosad 40 g AI/ha	5.00a	3.75bc	3.50c	10.00bc
Spinosad 60 g AI/ha	2.50b	2.00cd	4.25c	7.25cd
Spinosad 80 g AI/ha	3.00b	2.50cd	6.00c	6.50cde
Spinosad 160 g AI/ha	3.00b	0.75b	3.50c	3.75de
Spinosad 40 g AI/ha + Bravo 2.25 L prod/ha	3.00b	2.50cd	8.00c	10.25bc
Ripcord 35 g AI/ha	5.00a	4.75b	19.75b	14.75b
Admire 0.2 L prod/ha	1.50b	0.25d	3.00c	1.25

* Treatment means followed by the same letter are not significantly different ($P \leq 0.05$, Duncan's New MRT).

PMR REPORT # 51 **SECTION C: POTATO INSECTS**
STUDY DATA BASE #: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato flea beetle (PFB), *Epitrix cucumeris* (Harris)
Potato aphid (APH), *Macrosiphum euphorbiae* (Thomas)
Tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois)

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TITLE: MANAGEMENT OF POTATO PESTS USING MATADOR

MATERIALS: MATADOR 120 EC (ë-cyhalothrin); ADMIRE 240 SC (imidacloprid)

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island, on May 24, 1997, in 4-row plots with plants spaced at 0.4 m within rows and 0.9 m between rows. Plots were 7.6 m long and 3.6 m wide, and were arranged in a randomized complete block design, with five treatments and four replications. They were separated from each other within a replicate by two buffer rows of potatoes. Three counts of CPB egg masses, early instars (L1-L2), late instars (L3-L4), and adults were done on five plants from the two center rows of each plot from July 8, when 50% of the selected egg masses in the Check plots had hatched, until July 14. When average counts exceeded 20 pests per Check plot (July 14), all treatments were applied as foliar sprays, using a CO_2-pressurized precision-plot sprayer at an output of 303 L/ha and a pressure of approximately 240 kPa. A second application, to be made if a threshold of 2.0 Colorado Potato Beetle Equivalents (CPBE) per plant was reached on July 21, was not required. The multiplication of spring adults by 1.0, L1-L2 larvae by 0.125, L3-L4 larvae by 0.333, or summer adults by 0.625 converts each growth stage to its CPBE. Post-spray counts of CPB were done on July 17, July 21, and on a weekly basis thereafter until August 25. Counts of potato flea beetle adults, potato aphids, tarnished plant bugs, and beneficial insects were done from ten net sweeps (0.4 m diameter) of each plot on the same schedule. To prevent interplot movement of CPB, an application of aryl heterocycle (FIPRONIL) was made to the buffer rows on July 25. Percent defoliation was determined on ten plants from the two center rows of each plot at seven days post-spray, and whole-plot defoliation ratings were done weekly from July 21 to August 29. Crop phytopathology was noted at one and seven days post-spray. Weeds were controlled with a pre-emergence application of metribuzin at 1.1 kg AI/ha on June 12. For control of late blight, plots received recommended applications of chlorothalonil or copper hydroxide, both at the rate of 1.25 kg AI/ha, as well as mancozeb at 1.6 kg AI/ha and propomocarb at 1.6 l AI/ha. All plots were sprayed with diquat at 370 g AI/ha on September 2 for top desiccation. On September 15, tubers were harvested from the 2 center rows of each plot, and total and marketable (>38 mm dia.) yields were recorded. Analyzes of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln (x + 1) and percent defoliation was transformed to sqrt (arcsine (prop)) before analyzes. The detransformed means are presented.

RESULTS: Results are summarized in the tables that follow.

CONCLUSIONS: Although below-normal numbers of overwintered CPB adults led to diminished populations of all stages of the insect throughout the summer, the single applications of all three rates of MATADOR and of the single rate of ADMIRE on July 14 proved efficacious. On July 17 and 21, all treatments gave significant control of early instars (Table 1), and the trend continued until August 5 (data not shown). All treatments effectively controlled late instars from July 17 through August (Table 1), and summer adults throughout the growing season (Table 2). Overall, all three rates of MATADOR were as efficacious as the single ADMIRE treatment at reducing numbers of early and late instars (Table 1) and adults (Table 2) compared to the untreated Check. Levels of defoliation due to CPB feeding remained low throughout the summer, however, all treatments significantly reduced damage on both a weekly and a seasonally-averaged basis in comparison with the Check (Table 2). ADMIRE and the high rate of MATADOR appeared to be, on the average, slightly more effective than the two lower rates of MATADOR, but the differences were not significant (Table 2). On July 17, at three days post-spray, potato flea beetle populations were reduced in all treated plots, with MATADOR at all levels of treatment being more effective than ADMIRE (Table 2). MATADOR alone, at all rates, still gave effective control on July 21 (Table 2), but there appeared to be no further residual effects after that (data not shown). No consistent control of potato aphids or tarnished plant bugs was provided by any treatment. Beneficials found in the sweeps consisted of arachnids (spiders and harvestmen), and ladybeetle larvae and adults of several species. Their populations were consistently low throughout the summer. However, based on seasonal averages, more ladybeetle larvae were retrieved from the untreated Check than from plots treated with insecticides (data not shown). No significant differences in tuber yields resulted from any of the treatments. Yields averaged 33.6 t/ha for marketable tubers (dia.>38 mm) and 34.6 t/ha for all tubers. No phytotoxicity was observed in any plots.

Table 1. Efficacy of several insecticides and different rates of insecticides against CPB early- and late-instars.

Treatment	Rate (g AI/ha)	No. of early instars /plant		No. of late instars /plant				
		35627	35631	35627	35631	35638	Aug.05	season average
CHECK		6.15a*	15.35a	1.25a	3.05a	8.15a	5.45a	2.17a
MATADOR 120 EC	10	0.95b	0.70b	0.40b	0.35b	0.90b	1.05b	0.94b
MATADOR 120 EC	15	0.45b	1.25b	0.25b	0.05b	0.25bc	0.95b	0.48b
MATADOR 120 EC	20	2.50b	0.05b	0.15b	0.10b	0.10c	1.00b	0.61b
ADMIRE 240 SC	48	0.00b	0.00b	0.00b	0.05b	0.00c	0.45b	0.41b

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. Efficacy of several insecticides and different rates of the insecticides on CPB summer adults, plot defoliation, and potato flea beetles.

Treatment	Rate (g AI/ha)	No. of summer adults/plant			% defoliation**	No. of PFB /10sweeps	
		Aug.18	Aug.25	season average	season average	35627	35631
CHECK		2.80a*	1.75a	0.52a	14.20a	42.50a	13.00a
MATADOR 120 EC	10	0.85b	0.55b	0.19b	1.93b	0.25c	3.25b
MATADOR 120 EC	15	0.70b	0.35b	0.16b	1.86b	0.00c	1.00b
MATADOR 120 EC	20	0.40b	0.30b	0.16b	1.43bc	0.75c	3.25b
ADMIRE 240 SC	48	0.10b	0.10b	0.07b	0.83c	5.00b	15.00a

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

** The data were transformed to the sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

PMR REPORT # 52 **SECTION C: INSECT PESTS**
STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say); potato flea beetle (PFB), *Epitrix cucumeris* (Harris); potato aphid (APH), *Macrosiphum euphorbiae* (Thomas)

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TITLE: CONTROL OF INSECTS ON POTATOES

MATERIALS: TD 2344-02 0.83EC (synthetic pyrethrinoid), THIODAN 4EC (endosulfan), Food Grade Soybean Oil, GARLIC BARRIER (garlic oil), FISH OIL.

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island, on May 24, 1997, in 4-row plots with plants spaced at 0.4 m within rows and 0.9 m between rows. Plots were 7.6 m long and 3.6 m wide, and were separated from each other within a rep by two buffer rows of potatoes. With the exception of the GARLIC BARRIER treatment, which was isolated on the north (lee) side of the experiment, plots were arranged in a randomized complete block design. There were six treatments and four replications. Beginning on July 15, and on a weekly basis thereafter until August 28, counts of potato flea beetle adults, potato aphids, and CPB early instars (L1-L2), late instars (L3-L4), and adults were done from 10 net sweeps of the two center rows of each plot. Treatments were to be applied whenever a threshold of 2.0 CPBE per net sweep was reached or exceeded. The multiplication of spring adults by 1.0, L1-L2 larvae by 0.125, L3-L4 larvae by 0.333, or summer adults by 0.625 converts each growth stage to its CPBE. Since it appeared that the threshold would not be reached, all treatments were applied on July 24. GARLIC BARRIER was applied again on August 21 when the 2.0 CPBE threshold was reached. All treatments were applied as foliar sprays, using a CO_2-pressurized precision-plot sprayer at an output of 303 L/ha and a pressure of approximately 240 kPa. FISH OIL at a ratio of 1:100 v/v with the water was added as a sticker to the GARLIC BARRIER treatment. To prevent interplot movement of CPB, an application of aryl heterocycle (FIPRONIL) was made to the buffer rows on July 25. Defoliation ratings were done weekly from July 18 to August 29. Weeds were controlled with a pre-emergence application of metribuzin at 1.1 kg AI/ha on June 12. For control of late blight, plots received recommended applications of chlorothalonil or copper hydroxide, both at the rate of 1.25 kg AI/ha, as well as mancozeb at 1.6 kg AI/ha and propomocarb at 1.6 l AI/ha. All plots were sprayed with diquat at 370 g AI/ha on September 2 for top desiccation. On September 15 and 16, tubers were harvested from the 2 center rows of each plot, and total and marketable (>38 mm dia.) yields were recorded. Analyzes of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln (x + 1) and percent defoliation was transformed to sqrt (arcsine (prop)) before analyzes. The detransformed means are presented.

RESULTS: Results are summarized in Tables 1-3 that follow.

CONCLUSIONS: A single application of TD 2344-02 reduced early instars (Table 1) and later instars (Table 2) relative to the Check. Even though these differences were not always statistically validated, defoliation in the TD 2344-02 plots was significantly lower from Aug. 1 to Aug. 29 than in the Check (Table 3). Compared to the Check, the high rate of THIODAN provided consistent control of early (Table 1) and later instars (Table 2), and limited damage to potato foliage (Table 3). The half rate of THIODAN was not as efficacious as the high rate with respect to insect control (Tables 1 and 2) and foliage protection (Table 3). The addition of soybean oil to the half rate of THIODAN did not improve its efficacy (Tables 1, 2, and 3). GARLIC BARRIER was completely ineffective for the management of the CPB.

Table 1. Management of early CPB instars with insecticides or an alternative, Harrington, P.E.I., 1997

Treatment	Rate (L/prod/ha)	Mean No. Early Instars / 10 Sweeps					
		--------July--------		-------------August----------			Seasonal Average
		22	29	- 8	12	20	
Check	-	12.8	10.3ab*	10.8a	8.5a	0.8	6.3ab
TD 2344-02	0.4	13.3	1.0d	5.3a	4.8ab	0	3.6bc
THIODAN	1.4	13.5	3.0cd	0.8b	1.0c	0	2.9c
THIODAN	0.7	8	5.8abc	9.8a	4.3ab	0	4.1bc
THIODAN + SB OIL	0.70 + 0.93	5.8	2.5bcd	4.8a	3.0bc	0.3	2.5bc
GARLIC OIL	0.47	22.8	11.3a	8.8a	11.3a	0.3	9.3a
ANOVA $P<0.05$		ns	----	----	----	ns	----

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. Management of later CPB instars with insecticides or an alternative, Harrington, P.E.I., 1997

Treatment	Rate (L/prod/ha)	Mean No. Later Instars / 10 Sweeps					
		--------July--------		-------------August------------			Seasonal Average
		22	29	8	12	20	
Check	-	15.3	13.0a*	26.3a	22.8	14.3	13.3ab
TD 2344-02	0.4	25.5	3.3b	5.0cd	17.3	11.3	9.1abc
THIODAN	1.4	14.8	1.5b	4.0d	8.8	5.3	5.0c
THIODAN	0.7	15.8	1.3b	10.8abc	12.5	11.3	7.5abc
THIODAN + SB OIL	0.70 + 0.93	12	1.8b	6.3bcd	11.3	8.8	5.9bc
GARLIC OIL	0.47	36	17.5a	17.8ab	11.5	16.3	14.6a
ANOVA $P \leq 0.05$		ns	----	----	ns	ns	----

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 3. Defoliation of plots treated with insecticides or an alternative, Harrington, P.E.I., 1997

Treatment	Rate (L/prod/ha)	% Defoliation**							
		----July----		--------------------August--------------------					Seasonal
		18	25	1	8	15	22	29	Average
Check	-	0	3.4a*	4.0ab	17.0a	22.9a	22.9a	27.8a	14.1a
TD 2344-02	0.4	0	2.4ab	1.5cd	1.8d	5.4bc	7.0bc	7.9bc	3.7bc
THIODAN	1.4	0	1.2bc	1.0d	1.4d	3.4c	3.4c	3.4c	2.0c
THIODAN	0.7	1	1.0c	1.5cd	3.8c	8.0bc	8.9bc	8.9bc	4.7bc
THIODAN + SB OIL	0.70+0.93	0	2.4ab	2.5cd	3.8c	10.8b	10.8b	11.6b	6.0b
GARLIC OIL	0.47	1	3.8a	5.1a	7.2b	25.8a	31.4a	32.8a	15.2a
ANOVA P≤0.05		ns	----	----	----	----	----	----	----

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test (P≤ 0.05).

** The data were transformed to the sqrt (arcsine (prop)) before analysis. Detransformed means are presented

PMR REPORT # 53

SECTION C: INSECT PESTS OF POTATOES
STUDY DATA BASE #: 303-1452-8702

CROP: Potato, cv. Superior
PESTS: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato flea beetle (PFB), *Epitrix cucumeris* (Harris)

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TITLE: **CONTROL OF THE COLORADO POTATO BEETLE (CPB) IN POTATOES USING SPINOSAD**

MATERIALS: SPINOSAD 480 SC (NAF85) (spinosyn A/D); ADMIRE 240 FS (imidacloprid); GUTHION 240 SC (azinphos-methyl); DPX MP062; PBO (piperonyl butoxide 92%)

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island, on May 24, 1997, in 4-row plots with plants spaced at 0.4 m within rows and 0.9 m between rows. Plots were 7.6 m long and 3.6 m wide, and were arranged in a randomized complete block design with nine treatments and four replications. They were separated from each other within a replicate by two buffer rows of potatoes. Initial treatments were applied to all plots on July 8th as foliar sprays, using a CO_2-pressurized precision-plot sprayer at an output of 303 L/ha and a pressure of approximately 240 kPa, upon hatch of 30% of the egg masses monitored in the Check plots. Additional sprays were applied, to only the GUTHION (August 15th) and both DPX MP062 (August 20th) plots, when a threshold of 2.0 CPBE was reached. The multiplication of spring adults by 1.0, L1-L2 larvae by 0.125, L3-L4 larvae by 0.333, or summer adults by 0.625 converts each growth stage to its CPBE. To prevent interplot movement of CPB, an application of aryl heterocycle (FIPRONIL) was made to the buffer rows on July 2. On July 11, and on a weekly basis from July 15 to August 25, counts of CPB early instars (L1-L2), late instars (L3-L4), and adults were done on 5 plants from the center 2 rows of each plot, while PFB adults were counted from 10 net sweeps per plot. Defoliation ratings were done weekly from July 18 to August 29. Weeds were controlled with a pre-emergence application of metribuzin at 1.1 kg AI/ha on June 12. For control of late blight, plots received recommended applications of chlorothalonil or copper hydroxide, both at the rate of 1.25 kg AI/ha, as well as mancozeb at 1.6 kg AI/ha and propomocarb at 1.6 l AI/ha. All plots were sprayed with diquat at 370 g AI/ha on September 2 for top desiccation. On September 15 and 16, tubers were harvested from the 2 center rows of each plot, and total and marketable (>38 mm dia.) yields were recorded. Analyzes of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln (x + 1) and percent defoliation was transformed to sqrt (arcsine (prop)) before analyzes. The detransformed means are presented.

RESULTS: Results are summarized in Tables 1-3 that follow.

CONCLUSIONS: Fewer early instars were observed on July 11 and from July 22 to July 28 in plots treated with ADMIRE and GUTHION than in the Check (Table 1). On July 28, the 80 and 160 g AI/ha rates of SPINOSAD were as efficacious as ADMIRE and GUTHION. No obvious rate response was noted for the four rates of SPINOSAD tested, but the 80 and 160 g AI /ha rates tended to be more efficacious than the lower rates. From July 15 to July 28, the higher rate of PBO with DPX was more effective against early-instar larvae than was the same amount of active ingredient with the 140 g AI/ha rate of PBO. Although not always significant, plots treated with ADMIRE, SPINOSAD at 160 g AI/ha, GUTHION, and DPX with the high rate of PBO tended to have fewer late instars than the Check (Table 1). A rate response in numbers of late-instar larvae was noted for SPINOSAD on July 28. Management of the potato flea beetle was achieved using ADMIRE, SPINOSAD at 80 and 160 g AI/ha, GUTHION, and DPX with both rates of PBO on July 11 and to a lesser extent on July 15 (Table 3). No late-season efficacy was noted for any of the single-application treatments, but the GUTHION spray on August 15 gave significant control PFB on August 18. Relative to the Check, defoliation in all treated plots remained low until about August 15 (Table 2). Only ADMIRE continued to protect foliage after this date. No significant differences in tuber yields were observed among any of the treatments. Yields averaged 33.4 t/ha for marketable tubers (dia. >38 mm) and 34.4 t/ha for all tubers. No phytotoxicity was observed throughout the experiment.

Table 1. Efficacy of several insecticides and different rates of insecticides against CPB early and late instars.

Treatment	Rate (g ai/ha)	Mean number of CPB early instars (L1-L2) / 5 plants				Mean number of CPB late instars (L3-L4)/ 5 plants		
		35986	July 15	35997	July 28	35997	36003	36011
Check		2.6	2.7	6.1	13.7a*	2.8abcd	6.0ab	6.5
ADMIRE 240 FS	48	0.1	1.4	1.3	0.5c	0.1	1.4c	0.7
SPINOSAD 480 SC	40	0.9	4.1	5.5	4.9abc	0.5de	7.8a	3.1
SPINOSAD 480 SC	60	4	1.8	3.5	8.9ab	1.2cde	7.5a	6.2
SPINOSAD 480 SC	80	4.3	1.2	3.8	2.6bc	4.0abc	3.2bc	2
SPINOSAD 480 SC	160	2.6	2.9	3	3.1c	1.0bcde	1.8c	2
GUTHION 240 SC	600	2	4.6	4.2	1.2c	5.3ab	1.5c	2.2
DPX MP062 +PBO	25+140	1.2	3.8	9.4	1.7bc	4.1a	3.4abc	1.9
DPX MP062 +PBO	25+280	3.6	2.5	2.4	1.4c	1.8abcde	3.6abc	2.3
ANOVA $P \leq 0.05$		ns	ns	ns	----	----	----	ns

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. Effect of several insecticides and different rates of insecticides on plot defoliation.

Treatment	Rate (g ai/ha)	Percent Defoliation** July 18	July 25	August 1	August 8	August 15
Check		2.4a*	2.9ab	4.3a	12.9a	23.1a
ADMIRE 240 FS	48	.0d	0.3d	0.3d	2.5cd	3.3d
SPINOSAD 480 SC	40	1.3abc	3.0a	3.4ab	4.8bc	12.1bc
SPINOSAD 480 SC	60	0.3bcd	1.9abc	2.0bc	5.0b	11.4bc
SPINOSAD 480 SC	80	0.0cd	1.3c	1.5c	1.5d	7.3cd
SPINOSAD 480 SC	160	0.1bcd	1.4bc	2.0bc	4.5bc	13.6abc
GUTHION 240 SC	600	1.3abc	2.5abc	3.6ab	3.4bc	16.3ab
DPX MP062 +PBO	25+140	1.4ab	2.0abc	3.8ab	5.1b	10.5bc
DPX MP062 +PBO	25+280	0.4abcd	1.9abc	2.9abc	4.1bc	14.5abc

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test (P≤ 0.05).

** The data were transformed to the sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

Table 3. Efficacy of several insecticides and different rates of insecticides for control of PFB adults.

Treatment	Rate (g ai/ha)	Mean number of PFB adults/10 sweeps July 11	July 15	July 22	August 11	August 18
Check		50.5a*	12.0ab	35.5	105	189.5a
ADMIRE 240 FS	48	3.3	9.3ab	50	86	202.5a
SPINOSAD 480 SC	40	32.3ab	21.0a	40.5	98	227.0a
SPINOSAD 480 SC	60	35.5ab	11.5ab	32.3	82.5	248.5a
SPINOSAD 480 SC	80	16.0c	13.5ab	37.3	127.5	263.8a
SPINOSAD 480 SC	160	21.8bc	17.8a	30	123.8	216.8a
GUTHION 240 SC	600	7.0d	11.3ab	28	106.8	81.8b
DPX MP062 +PBO	25+140	7.0d	9.0bc	32.3	93.8	221.8a
DPX MP062 +PBO	25+280	5.8de	4.5c	27	109	239.5a
ANOVA P<0.05		----	----	ns	ns	----

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test (P≤ 0.05).

PMR REPORT # 54 **SECTION C: INSECT PESTS OF POTATOES**
STUDY DATA BASE: 280-1252-9304

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: RELATIVE PERSISTENCE OF CONTROL AGENTS APPLIED TO POTATO FOLIAGE FOR CONTROL OF COLORADO POTATO BEETLE - 1997

MATERIALS: ADMIRE 240 F (imidacloprid), SPINOSAD 480 SC (NAF 85)(spinosyn A/D), NOVODOR (ABG 6473)(*Bacillus thuringiensis* var. *tenebrionis*), RIPCORD 400 EC (cypermethrin), ALERT 240 SC (chlorfenapyr), GOVERNOR 75WP (cyromazine), REGENT 200 F (fipronil)

METHODS: Chitted seed potatoes were planted in London on May 13 in single-row (10 plants/row) microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated three times in a randomized complete block design. On June 27 when plants were in full flower, 55 fully expanded leaves were tagged in each plot. On June 30 all treatments (Table 1) were applied at 275 kPa in 900 L/ha using a hand-held, single-nozzled (D-4-25 hollow cone) R&D plot sprayer. Residual effectiveness of foliar deposits against both adult and larval insecticide-susceptible, laboratory-reared CPB was measured by bioassay. As soon as spray deposits had dried on the foliage, a total of 6 tagged leaves were harvested from each plot of each treatment and returned to the laboratory for bioassay. Tagged leaves were thereafter collected at regular intervals for further bioassay (Tables 2-3). On each collection date a total of 9 adult-bioassays (3 bioassays/plot x 3 reps/tmt.), each containing 1 trifoliate leaf and 5 CPB adults, and 6 larval-bioassays (2 bioassays/plot x 3 reps/tmt.), each containing 2 x 3.55 cm leaf discs and 10 first instars, was established for each treatment. Bioassays were held at 25• C, 55% RH, and 16:8 L:D photoperiod. For each set of bioassays mortality and leaf damage were recorded after 72 hrs. Mortality was corrected using Abbott's correction and then subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; Least Squares Differences (LSD) were calculated and used to estimate significance of differences among treatment means. Adult-damage reduction was determined by subtracting individual bioassay damage ratings from the average CONTROL damage rating and calculating % reduction. Areas of leaf discs remaining after 72 hrs were read directly using a LI-COR portable leaf area meter; larval damage reductions were calculated by subtracting leaf-areas consumed in individual treatment bioassays from the mean leaf area consumed in CONTROL bioassays and calculating % reduction. The length of time, in days, that feeding damage in treatment plots was at least 70% less than feeding damage in untreated CONTROL plots and/or that corrected mortality of CPB feeding on treated leaves exceeded 70% (T70), was estimated visually by drawing a line vertically from the intersection of the arbitrarily chosen 70% response level with a plot of CPB Response (corrected % mortality or % damage reduction) against Days after Treatment.

RESULTS: See Tables 2-4 below. Since Adult-Damage Reduction following application of REGENT fell just below 70% on 3 DAT and remained very close to 70% until 7 DAT, two T70's are shown for this insecticide (Table 4). No rain fell during the 48 hrs after application. A total of 7.8 mm of rainfall subsequently accumulated by 3 days after treatment (DAT). Temperature reached 27.3° C on Day 0 and averaged 22.9° C over the first 3 DAT. A total of 20.7 hrs of bright sunshine were recorded by 3 DAT. No phytotoxicity was noted following treatment.

Table 1. Control agents applied to potato foliage - 1997.

Tmt. No.	Treatment Applied	Rate (Pdct./ha)	Tmt. No.	Treatment Applied	Rate (Pdct./ha)
1.	ADMIRE 240 F	0.2 L	5.	ALERT 240 SC	0.4 L
2.	SPINOSAD 480 SC	165.0 ml	6.	REGENT 200 B.1 L	
3.	NOVODOR	7.0 L	7.	GOVERNOR 75 WP	375.0 g
4.	RIPCORD 400 EC	87.5 ml	8.	CONTROL	---

CONCLUSIONS: At the arbitrary threshold of 70% CPB response, under the weather conditions of this experiment, we noted large differences in the relative persistence of tested control agents on potato foliage (Tables 2,3). As measured by mortality of first instars, the observed order of persistence was RIPCORD (7.9 days) > ALERT > REGENT > SPINOSAD > ADMIRE > NOVODOR (0.7 day); the single application of GOVERNOR did not exceed the 70% threshold for damage reduction at any time (Table 4). As measured by reduction of leaf feeding by first instars, the observed order of persistence was REGENT (10.8 days) > RIPCORD > SPINOSAD > ADMIRE > NOVODOR > ALERT > GOVERNOR (0.8 day). As measured by mortality of adult CPB, the observed order of persistence was REGENT (8.2 days) > ALERT > SPINOSAD > RIPCORD > ADMIRE (1.4 days)(Table 4). As measured by reduction of leaf feeding by adult CPB, the observed order of persistence was REGENT (6.8 days) > ADMIRE > RIPCORD > SPINOSAD (2.1 days); ALERT did not exceed the 70% threshold for adult damage reduction at any time. ALERT thus appears to be a persistent but slow acting toxin; while CPB placed on treated foliage as long as 4.7 days after insecticide application ultimately die, they caused significantly damage before succumbing. These data again emphasize the importance of field scouting since, with the exception of REGENT, tested control agents were more toxic to early instar larval CPB than to adult CPB.

Table 2. Relative persistence of control agents applied to potato foliage for control of Colorado potato beetle larvae.

Tmt. Applied	Colorado Potato Beetle Larva Response on Indicated Day*							
	Day 0		Day 1		Day 2		Day 3	
	Mort.**	D.R.***	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
1	100.0 b	98	94.4 c	96.4	83.0 b	100	28.5 b	48.7
2	100.0 b	96.5	98.1 c	91.6	100.0 b	100	60.0 c	71.7
3	100.0 b	100	53.7	98.7	7.9 a	0	0.3 a	0.0
4	100.0 b	100	100.0 c	100	100.0 b	100	100.0 e	81.0
5	98.3 b	50.7	94.4 c	76.3	89.8 b	41.2	83.6 de	32.3
6	100.0 b	93.7	100.0 c	100	100.0 b	100	74.5	78.8
7	53.3 a	90.5	18.5 a	65.9	22.0 a	43.6	2.4	4.0
8	1.34*****		1.03		0.96		1.45	

Tmt. Applied	Colorado Potato Beetle Larva Response on Indicated Day							
	Day 7		Day 10		Day 15		Day 22	
	Mort.*	D.R.**	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
1	11.7 a	33.7	3.3 a	0	0.0 a	0	****	****
2	23.3 ab	29.1	0.0 a	0	****	****	****	****
NOV.	3.3 ab	31	0.0 a	61.5	****	****	****	****
4	88.3 d	95.7	33.3 b	64.4	24.1 b	25.1	****	****
5	51.7 bc	50.7	0.0 a	0	****	****	****	****
REG.	55.0 c	90.9	11.7 a	76	19.5 b	41.6	3.3	67.8
7	13.3 ab	61.4	13.3 a	78.7	****	****	****	****
CHECK	1.37		2.6		1.12		2.5	

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

** Corrected % Mortality.

*** % Damage Reduction relative to feeding damage in leaves from CONTROL plots (Tmt. 8).

**** Bioassay not undertaken due to lack of efficacy in earlier test.

***** Actual area (cm^2) of leaf discs consumed in CONTROL bioassays during 72 hr feeding period.

Table 3. Relative persistence of control agents applied to potato foliage for control of Colorado potato beetle adults.

Tmt. Applied	Colorado Potato Beetle Adult Response on Indicated Day*							
	Day 0		Day 1		Day 2		Day 3	
	Mort.**	D.R.***	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
ADM.	71.1 a	96.9	84.4 a	95.5	51.1 a	92	20.8 b	86.7
SPIN.	97.8 c	85.8	100.0 b	83.2	100.0 b	82.4	10.2 a	0
RIP.	86.7 b	93.3	84.4 a	91.8	64.4 a	91.1	39.8 b	72.9
ALERT	100.0 c	53.8	91.1 ab	53.5	88.9 b	22.3	70.4 c	0
REG.	100.0 c	85.5	100.0 b	82.5	100.0 b	83.7	100.0 d	65.3
CHECK	7.6*****		7.7		7.4		7.2	

Tmt. Applied	Colorado Potato Beetle Adult Response on Indicated Day							
	Day 7		Day 10		Day 15		Day 22	
	Mort.*	D.R.**	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
ADM.	70.5 c	45	0.0 a	40.8	2.2 a	31	****	****
SPIN.	2.0 a	13.8	0.0 a	0	****	****	****	****
RIP.	6.1 a	20.9	0.0 a	16.2	****	****	****	****
ALERT	34.8 b	0	12.0 b	5	****	****	****	****
REG.	88.9 c	67.9	13.1 b	44.3	11.6 b	30.4	6.7	0
CHECK	8.4		8.8		9.2		8.2	

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

** Corrected % Mortality.

*** % Damage Reduction relative to feeding damage in leaves from CONTROL plots (Tmt. 8).

**** Bioassay not undertaken due to lack of efficacy in earlier test.

***** Actual 72-hour Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

Table 4. Relative foliar T70's for control agents applied to potato for control of Colorado potato beetle.

Tmt. No.	Treatment Applied	Rate (amt/ha)	T70* (days) for Indicated CPB Response			
			Damage Reduction		% Mortality	
			Adult	Larva	Adult	Larva
1	ADMIRE 240F	0.2 L	4.5	2.5	1.4	2.2
2	SPINOSAD 480SC	165.0 ml	2.1	3.1	2.3	2.7
3	NOVODOR	7.0 L	**	1.3	**	0.7
4	RIPCORD 400E	87.5 ml	3.2	9.4	1.7	7.9
5	ALERT 240SC	0.4 L	0	1	3	4.7
6	REGENT 200F	0.1 L	2.7/6.8***	10.8	8.2	3.9
7	GOVERNOR 75WP	375.0 g	**	0.8	**	0

* Time period (days) that feeding damage in treatment plots was at least 70% less than feeding damage in untreated CONTROL plots and/or that corrected mortality of CPB feeding on treated leaves exceeded 70%.

** Bioassays not done due to demonstrated lack of effect on noted life stage.

*** Damage reduction dropped just below 70% at 2.7 days but remained very close to 70% until 6.8 days after application.

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: RELATIVE PERSISTENCE OF SPINOSYN AND CHLORFENAPYR PROGRAMS APPLIED TO POTATO FOLIAGE FOR CONTROL OF COLORADO POTATO BEETLE - 1997

MATERIALS: SPINOSAD 480 SC (NAF 85)(spinosyn A/D), RIPCORD 400 EC (cypermethrin), ALERT 240 SC (chlorfenapyr)

METHODS: Chitted seed potatoes were planted in London on June 16 in single-row (10 plants/row) microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated three times in a randomized complete block design. On July 21 when plants were beginning to bud, 55 fully expanded leaves were tagged in each plot. On July 22 all treatments (Table 1) were applied at 275 kPa in 900 L/ha using a hand-held, single-nozzled (D-4-25 hollow cone) R&D plot sprayer. On July 28 Tmt. 1 was applied to appropriate plots for a second time. Residual effectiveness of foliar deposits against both adult and larval insecticide-susceptible, laboratory-reared CPB was measured by bioassay. As soon as spray deposits had dried on the foliage, a total of 6 tagged leaves were harvested from each plot of each treatment and returned to the laboratory for bioassay. Tagged leaves were thereafter collected at regular intervals for further bioassay (Tables 2-3). On each collection date a total of 9 adult-bioassays (3 bioassays/plot x 3 reps/tmt.), each containing 1 tri-foliate leaf and 5 CPB adults, and 6 larval-bioassays (2 bioassays/plot x 3 reps/tmt.), each containing 2 x 3.55 cm leaf discs and 10 first instars, was established for each treatment. Bioassays were held at 25• C, 55% RH, and 16:8 L:D photoperiod. For each set of bioassays mortality and leaf damage were recorded after 72 hrs. Mortality was corrected using Abbott's correction and then subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; Least Squares Differences (LSD) were calculated and used to estimate significance of differences among treatment means. Adult-damage reduction was determined by subtracting individual bioassay damage ratings from the average CONTROL damage rating and calculating % reduction. Areas of leaf discs remaining after 72 hrs were read directly using a LI-COR portable leaf area meter; larval damage reductions were calculated by subtracting leaf-areas consumed in individual treatment bioassays from the mean leaf area consumed in CONTROL bioassays and calculating % reduction. The length of time, in days, that feeding damage in treatment plots was at least 70% less than feeding damage in untreated CONTROL plots and/or that corrected mortality of CPB feeding on treated leaves exceeded 70% (T70), was estimated visually by drawing a line vertically from the intersection of the arbitrarily chosen 70% response level with a plot of CPB Response (corrected % mortality or % damage reduction) against Days after Treatment.

RESULTS: See Tables 2-4 below. No rain fell by 3 days after treatment (DAT) for either application. Temperature reached 25.4• C on Day 0 and averaged 20.6• C over the first 3 DAT for the first application. A total of 22.8 hrs of bright sunshine were recorded by 3 DAT. For the second application temperature peaked at 23.7• C on Day 0 and averaged 20.3• C over the first 3 DAT. A total of 38.9 hrs of bright sunshine were recorded by 3 DAT. No phytotoxicity was noted following treatment.

Table 1. Control agents applied to potato foliage - 1997.

Tmt. No.	Treatment Applied	Rate (Pdct./ha)	Tmt. No.	Treatment Applied	Rate (Pdct./ha)
1.	SPINOSAD 480 SC	85.0 ml x 2	5.	RIPCORD 400 EC	87.5 ml
2.	SPINOSAD 480 SC	165.0 ml	6.	CONTROL	---
3.	ALERT 240 SC	0.4 L			
4.	ALERT 240 SC + RIPCORD 400 EC	0.4 L 87.5 ml			

CONCLUSIONS: Under the weather conditions of this experiment, foliar residues of either rate of application of SPINOSAD effectively controlled first instars 3 DAT; mortality, however, was significantly higher in plots treated with the higher rate. Neither rate effectively reduced first instar survival by 6 DAT (Table 2). A similar relationship was noted for control of CPB adults. Effective adult control, however lasted for only 2 days (Table 3). A second application of SPINOSAD at 85.0 ml/ha 7 DAT restored effective control of first instars until 2 days after the second treatment (Table 2). Doubling the rate of application of SPINOSAD did not double its T70 (Table 4) for either first instars or CPB adults. T70's for first instars werehigher than for adults, particularly for the first application (Table 4); the differential was more pronounced for the lower rate of application of SPINOSAD. All things considered, split application of SPINOSAD provided better CPB control than a single 2x application. A grower, however, would have to consider other factors such as weather, time, soil compaction, etc.

Foliar residues of ALERT killed at least 70% of introduced first instars and adult CPB for roughly 4 days (Table 4). Application of ALERT alone did not, however, reduce adult feeding damage below the arbitrary threshold of 70% at any time (Table 4). As indicated by T70's, addition of ALERT to RIPCORD did not enhance performance of the pyrethroid. Indeed, T70's for RIPCORD alone were generally at least a day longer than the T70 for the tank mix combination (Table 4). Combination of ALERT with lower rates of RIPCORD might warrant investigation and could prove useful in populations with low levels of resistance to pyrethroids.

Table 2. Relative persistence of control agents applied to potato foliage for control of Colorado potato beetle larvae.

Tmt. Number	Colorado Potato Beetle Larva Response on Indicated Day*							
	Day 0		Day 1		Day 2		Day 3	
	Mort.**	D.R.***	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
1	100.0 a	95	100.0 a	96.7	100.0 a	99.3	83.3 a	86.8
2	100.0 a	94	100.0 a	94.2	100.0 a	93.2	96.7 b	96.5
3	100.0 a	95.6	100.0 a	93.7	100.0 a	92	100.0 b	87.2
4	100.0 a	98.6	100.0 a	97.3	100.0 a	97.2	100.0 b	97.5
5	100.0 a	97.4	100.0 a	97	100.0 a	98.2	100.0 b	93.7
6	5.64****		5.03		4.12		5.22	

Tmt. Number	Colorado Potato Beetle Larva Response on Indicated Day							
	Day 6		Day 8******		Day 9		Day 14	
	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
1	13.3 ab	65.4	98.3	98.1	93.3 b	92	23.3 b	60.1
2	25.0 b	66.7	–*****	--	35.0 a	47.7	3.3 a	52.1
3	1.7 ab	47.5	--	--	10.0 a	27.1	0.0 a	39.8
4	73.3 c	85.7	--	--	25.0 a	42.3	1.7 a	47.2
5	83.3 c	95.5	--	--	40.0 a	73.4	6.7 a	46.3
6	6.93		5.7		5.06		5.91	

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

** Corrected % Mortality.

*** % Damage Reduction relative to feeding damage in leaves from CONTROL plots (Tmt. 6).

**** Actual area (cm^2) of leaf discs consumed in CONTROL bioassays during 72 hr feeding period.

***** Bioassay not done.

****** Day 8 for initial applications of all 6 treatments; Day 1 for second application of SPINOSAD 480SC (Tmt. 1). Similarly Day 9 represents Day 2 and Day 14 represents Day 7 for the second application of SPINOSAD 480SC (Tmt.1).

Table 3. Relative persistence of control agents applied to potato foliage for control of Colorado potato beetle adults.

Tmt. Number	Colorado Potato Beetle Adult Response on Indicated Day*							
	Day 0		Day 1		Day 2		Day 3	
	Mort.**	D.R.***	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
1	100.0 a	87	93.3 b	78.3	95.6 b	49	11.1 a	4.1
2	100.0 a	90.7	100.0 b	90	100.0 b	81.4	60.0 b	9.9
3	100.0 a	59.1	100.0 b	56.1	97.8 b	9.7	97.8 c	6.7
4	95.6 a	94.6	95.6 b	94.6	64.4 a	71.8	73.3 b	67.7
5	97.8 a	93.9	71.1 a	85.9	65.0 a	75.8	77.8 b	77.8
6	10.0****		10		10		10	

Tmt. Number	Colorado Potato Beetle Adult Response on Indicated Day							
	Day 6		Day 8******		Day 9		Day 14	
	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.
1	6.3 a	7.8	93.3	58.8	77.8 b	61.2	0.0 a	6.2
2	0.0 a	16.2	_*****	--	0.0 a	4.6	0.0 a	3.5
3	37.4 b	16.3	--	--	0.0 a	2.4	0.0 a	6.3
4	4.0 a	20.8	--	--	0.0 a	13.3	0.0 a	9.4
5	0.0 a	18.5	--	--	8.9 a	26.1	0.0 a	4.7
6	9.9		9.9		10		9.9	

* Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using an LSD means separation test.

** Corrected % Mortality.

*** % Damage Reduction relative to feeding damage in leaves from CONTROL plots (Tmt. 6).

**** Actual 72-hour Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

***** Bioassay not done.

****** Day 8 for initial applications of all 6 treatments; Day 1 for second application of SPINOSAD 480SC (Tmt. 1). Similarly Day 9 represents Day 2 and Day 14 represents Day 7 for the second application of SPINOSAD 480SC (Tmt. 1).

Table 4. Relative foliar T70's for control agents applied to potato for control of Colorado potato beetle.

Tmt. No.	Treatment Applied	Rate (amt/ha)	T70* (days) for Indicated CPB Response			
			Damage Reduction		% Mortality	
			Adult	Larva	Adult	Larva
1	SPINOSAD 480SC	85.0 ml x2	1.3/0.0**	5.3/5.3**	2.3/2.4**	3.6/3.5**
2	SPINOSAD 480SC	165.0 ml	2.1	5.6	2.7	4.1
3	ALERT 240SC	0.4 L	0	4.3	4.3	3.9
4	ALERT 240SC + RIPCORD 400E	0.4 L + 87.5 ml	2.4	7.1	1.8/3.1***	6.2
5	RIPCORD 400E	87.5 ml	3.4	9.6	1.0/3.3***	7

* Time period (days) that feeding damage in treatment plots was at least 70% less than feeding damage in untreated CONTROL plots and/or that corrected mortality of CPB feeding on treated leaves exceeded 70%.

** Two applications were made, separated by 7 days. The second value in each pair represents the T70 for the second application.

*** For each pair of values, adult mortality dropped just below 70% at the first value for each pair, increased above 70% on Day 3 and then again fell below by the second T70 listed.

PMR REPORT # 56

SECTION C: INSECT PESTS OF POTATOES
STUDY DATA BASE #: 303-1452-8702

CROP: Potato, cv. Russet Burbank
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hubner)

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TITLE: **EUROPEAN CORN BORER CONTROL ON POTATOES**

MATERIALS: CONFIRM 240F (tebufenozide), FURADAN 480F (carbofuran)

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island on May 28, 1997, in 4-row plots (7.6 m long and 3.6 m wide) with plants spaced at 0.4 m within rows and 0.9 m between rows. Plots were arranged in a randomized complete block design with three treatments and four replications. Two buffer rows of potatoes separated each plot. The treatments were as follows: 1) Check; 2) tebufenozide at 144 g AI/ha; and 3) carbofuran at 528 g AI/ha. Twelve ECB egg masses were attached to the lower stems of plants in all plots on August 1. On August 8, after 50% egg masses reached the blackhead stage, the treatments were applied as foliar spays at 303 L/ha and a pressure of approximately 240 kPa, using a CO2- pressurized precision plot sprayer. Counts of ECB egg masses, larvae, and entrance holes were done nondestructively on 20 stalks per plot on August 15, 21, 28, and on September 12 and 18. Twenty stalks per plot were destructively sampled on October 6. Diquat was applied on September 18 and 25 as a foliar spray at 321 L/ha and a pressure of approximately 760 Kpa, using a 3-point hitch Hardi field sprayer to eliminate foliage prior to the harvesting of tubers. Colorado potato beetle (CPB) adults and larvae were counted weekly from 10 net sweeps per plot from July 16 to September 17. Buffer rows were sprayed with spinosyn A/D at 80 g AI/ha on July 25 to prevent inter-plot movement of the CPB. Percent defoliation was recorded weekly from Jul y 18 to September 18. Weeds were controlled with an application of metribuzin at 1.1 kg AI/ha on June 17, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha and copper hydronide at the same rate for control of late blight. Tubers from the centre two rows were harvested on October 7, and total and marketable (>38 mm dia.) tuber weights were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln (x+1). The detransformed means are presented.

RESULTS: Results are listed in the Table below.

CONCLUSIONS: No significant differences in the numbers of CPB adults or larvae were noted among treatments (data not shown). Other than the egg masses attached to plants, no additional ECB egg masses were found; suggesting that population levels of ECB on P.E.I. were low in 1997. Plots treated with either tebufenozide or carbofuran at 50% blackhead stage suffered less damage from the ECB than the check but the difference was not always statistically different (Table 1).

Table 1. Effects of two insecticides on limiting European Corn Borer (ECB) damage to potatoes, Harrington, P.E.I., 1997.

Treatment	Rate L prod/ha	Mean No. ECB Holes/ 10 Stalks				
		Aug. 15	Aug. 28	Sept. 12	Sept. 18	Seasonal Average
Check	-	1	2.9	4.3	6.2a	2.9a
Tebufenozide	0.6	0	0.4	1	1.2b	0.8b
Carbofuran	1.1	0	1	2.8	2.7b	1.3b
Anova P• 0.05		ns	ns	ns	---	---

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test (P• 0.05).

END OF SECTION C
NO REPORTS IN SECTION D

SECTION E - CEREAL, FORAGE AND OILSEED CROPS /CÉRÉALES, CULTURES FOURRAGÈRES ET OLÉAGINEUX

- Reports/Rapports # 57- 59
- Pages 144 - 154

Section Editor - Owen Olfert

PMR REPORT # 57 **SECTION E: INSECT PESTS OF CEREALS, FORAGE CROPS AND OILSEEDS**
ICAR/IRAC: 86100104

CROP: Canola, cv. Hyola
PESTS: Crucifer flea beetle, *Phyllotreta crucifera* (Goeze)
Striped flea beetle, *Phyllotreta striolata* (Fabr.)

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TITLE: A COMPARISON OF FLEA BEETLE CONTROL IN CANOLA BY NI-25, LINDANE, AND COUNTER SEED TREATMENTS, 1997

MATERIALS: See Table 1.

METHODS: The seed treatments for this trial were pre-mixed by Rhone-Poulenc. The appropriate amount of seed for each plot was taken from the mixture and placed in individual packets. Canola was seeded at a rate of 5 kg/ha in an early (May 15) and a later (May 29) planting at the Elora and Cambridge Research Stations, respectively. A 7-row, tractor-mounted cone seeder was used that evenly delivered the treated seed in rows spaced 18.0 cm apart. The plots, replicated four times, were trimmed to 5.0 m after seedlings emerged. Shot hole readings were taken in the early planting 3, 4, 7, 9, 11, 14, and 18 days after emergence, by evaluating the damage on 30 plants in the second and sixth rows of each plot. These readings commenced on May 29. In the later planting at Cambridge, these assessments were taken 3, 6, and 10 days after seedling emergence. The Cambridge readings began on June 10. The damage rating was done on the most recent stage of growth of the plant; damage on earlier tissue was ignored. In this way, the current efficacy of the treatment was evaluated. Damage to the two innermost leaves was recorded as 0 no damage, 0.5 = 12.5%, 1.0 = 25%, 2.0 = 50%, 3.0 = 75%, 4.0 = 100% of the leaf area consumed. Analysis
of variance was performed on the mean of the 30 observations per plot.

RESULTS: Damage data are shown in Tables 2 and 3.

CONCLUSIONS: In the Elora planting, only the LINDANE/COUNTER combination controlled flea beetle damage 3 days after seedling emergence, and this control persisted throughout the experiment. LINDANE by itself controlled damage from day 7 of the trial through day 18. There was a clear rate effect in the NI-25 treatments; the 2.5 rate had inconsistent results, the 5.0 rate provided control from day 7 to day 14, and the 7.5 and 10.0 rates were successful in keeping the flea beetle damage in check from day 4 through day 14. The control provided by the two high rates of NI-25 was surpassed only by the LINDANE/COUNTER treatment. In the Cambridge planting, all treatments controlled flea beetle for the entire 10-day sampling period when compared to the CHECK. In this trial, however, all the NI-25 treatments equalled or surpassed the control given by LINDANE and LINDANE/COUNTER treatments, with the exception of the low rate of NI-25 at 10 days. The lighter soils at Cambridge may account for the difference in the results of the two plantings. From the two plantings it is clear that NI-25 is a good alternative to LINDANE and COUNTER.

Table 1. Materials used for control of flea beetles on canola, 1997.

Treatments	Code	g AI/kg seed	Active Ingredients
EPX 80038	CHECK	3.0	iprodione
EPX 8072A		2.0	thiram
UNTREATED		-	
EPX 80534A	LINDANE	20.0	iprodione, thiram, lindane
EPX 80534A	LINTURB	20.0	iprodione, thiram, lindane
COUNTER 5G		22.0	terbufos
EPX 80038C	NI-25 2.5	3.0	iprodione
EPX 80728A		2.0	thiram
EPX 80667A		2.5	ni-25
EXP 80038C	NI-25 5.0	3.0	iprodione
EXP 80728A		2.0	thiram
EXP 80667A		5.0	ni-25
EXP 80038C	NI-25 7.5	3.0	iprodione
EXP 80728A		2.0	thiram
EXP 80667A		7.5	ni-25
EXP 80038C	NI-25 10.0	3.0	iprodione
EXP 80728A		2.0	thiram
EXP 80667A		10.0	ni-25

Table 2. Damage index* on canola foliage at various times after seedling emergence, early planting, Elora, 1997.

Treatments	Days after initial emergence of seedlings						
	3**	4	7	9	11	14	18
CHECK 0.18b	0.35b	0.90b	1.03d	0.86d	1.93c	1.17c	
LINDANE	0.09ab	0.20ab	0.23a	0.29bc	0.23a	0.86a	0.85b
LINTURB	0.05a	0.07a	0.26a	0.25a	0.28a	0.65a	0.54a
NI-25 2.5	0.07ab	0.15a	0.80b	0.65c	0.68cd	1.54bc	0.83b
NI-25 5.0	0.11ab	0.22ab	0.38a	0.57c	0.60bc	1.37b	1.15c
NI-25 7.5	0.07ab	0.17a	0.33a	0.51bc	0.48b	1.35b	1.01bc
NI-25 10.0	0.07ab	0.13a	0.45a	0.63c	0.50bc	1.59bc	1.18c

* See methods for a description of the damage rating scale.

** Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

Table 3. Damage index* on canola foliage at various times after seedling emergence, late planting, Cambridge, 1997.

Treatments		Days after initial emergence of seedlings		
		3**	6	10
CHECK		1.45c	1.65e	2.24d
LINDANE		0.48b	1.15d	1.59c
LINTURB		0.39b	0.82c	0.96b
NI-25	2.5	0.30ab	0.55bc	1.60c
NI-25	5.0	0.28ab	0.48b	1.10b
NI-25	7.5	0.31ab	0.34ab	1.00b
NI-25	10.0	0.15a	0.08a	0.58a

* See methods for a description of the damage rating scale.

** Means in each column followed by the same letter are not significantly different at $P \leq 0.05$ (Tukey's Studentized Range Test).

PMR REPORT # 58 **SECTION E:** **INSECT PESTS OF CEREALS, FORAGE CROPS AND OILSEEDS**
ICAR: 93000480

CROP: Kentucky bluegrass (*Poa pratensis* L.), cvs. Asset, Barcelona, Cynthia and Midnight
PEST: Silvertop, *Fusarium* spp., thrips, leafhoppers, aphids and mites

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TITLE: EFFICACY OF TWO INSECTICIDES AGAINST SILVERTOP ON FOUR CULTIVARS OF KENTUCKY BLUEGRASS AT BROOKS, ALBERTA, IN 1997

MATERIALS: CYGON 4E (dimethoate 480 g/L EC) and DECIS 5 EC (deltamethrin 50 g/L EC)

METHODS: Insecticide efficacy trials were conducted in experimental plots of cvs. Asset, Barcelona, Midnight and Cynthia Kentucky bluegrass seed at CDC South. Each of the cultivar plots was subdivided into three, 96 m^2 subplots with 6 m buffer strips between them. One of the following treatments was assigned to each subplot at random: CYGON 4E, DECIS 50 EC or an untreated check. Each insecticide was sprayed on May 5, May 16 and June 9. The sprayer was truck-mounted with a 6 m wide boom with Tee Jet 8002 nozzles, a boom pressure of 275 kPa, and a ground speed of 6.9 km/hr. CYGON was applied at 425 mL/ha and DECIS at 200 mL/ha, both in 100 L water/ha. The check plots were not sprayed. The May treatments were applied pre-heading and the June spray at early heading. Three, 1 m^2 areas (replicates) were staked out in each subplot and the number of silvertop heads were counted on June 13, 20, 27 and July 4. The subplots were swept for insects on July 10 and the general types determined. On July 14, three, 4 m^2 areas within each subplot were harvested, bagged, dried and threshed, and the seed was cleaned mechanically and weighed. Silvertop incidence and seed weight data were subjected to analysis of variance (ANOVA) and regression analysis. The silvertop incidence data were transformed prior to analysis where required.

RESULTS: See tables 1-5. Silvertop incidence levels were high to very high in all four grass cultivars.
Asset - On June 20, the DECIS treatment had significantly fewer silvertop heads than the CYGON and control treatments, otherwise the treatments were not significantly different at the various sampling times (Table 1a). DECIS-treated areas had a significantly lower percentage of silvertop heads than the CYGON-treated and control areas on three of four sampling dates (Table 1b). No yield data were taken due to poor seed set. Silvertop incidence increased steadily throughout the season in all subplots, although the rate was slower in those sprayed with insecticides. Statistically significant linear relationships between silvertop incidence and sampling date were observed for most treatments (Tables 5a, 5b).
Barcelona - No significant differences between treatments were seen for average number and percent of silvertop heads/m^2 (Tables 2a, 2b); however, the insecticide-treated subplots generally had a lower percentage of silvertop heads than the control. No significant differences in seed yield were observed between the three treatments. Statistically significant linear relationships between silvertop incidence and

sampling date were observed for only the insecticide treatments (Tables 5a, 5b).

Midnight - DECIS outperformed CYGON in terms of reducing silvertop incidence on all sampling dates and was significantly better than both the CYGON and control treatments in all but one case (Tables 3a, 3b). In most instances, CYGON was no better than the control. There were no significant differences in yield between treatments, although the DECIS-treated subplot produced over four times more seed than in the other two treatments. Statistically significant linear relationships between silvertop incidence and sampling date were observed for most treatments (Tables 5a, 5b).

Cynthia - DECIS sprays kept silvertop incidence significantly lower than in either the CYGON or control treatments on almost every sampling date (Tables 4a, 4b). There were no significant differences in yield between treatments, but CYGON- and DECIS-treated subplots produced 2-4 times as much seed compared to the control. Statistically significant linear relationships between silvertop incidence and sampling date were observed for all treatments (Tables 5a, 5b).

CONCLUSIONS: DECIS was more effective in reducing silvertop incidence than CYGON under the conditions of this trial. Insect and mite pests can incite silvertop directly and may also vector bacteria and fungi causing silvertop or predispose grass plants to natural infection by these microorganisms. This study pointed out the importance of early, i.e. pre-heading, application of insecticides. Further work is required to determine optimal timing and frequency of application.

Table 1a. Average number of silvertop heads in plots of Asset Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.*

	Average number silvertop heads/m^2 **			
Treatment	June 13	June 20	June 27	July 4
CYGON	8.4	19.6 a	20.9	28.0
DECIS	1.0	3.0 b	6.6	8.1
Control	10.8	32.9 a	30.6	30.6
ANOVA F-value	0.0574	0.0189	0.0937	0.1016

Table 1b. Percent silvertop heads and seed yields in plots of Asset Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.*

	Percent silvertop heads/m^2***				
Treatment	June 13	June 20	June 27	July 4	Seed yield (g/4 m^2)
CYGON	16.9	36.5 b	39.0 a	53.2 a	N/A
DECIS	1.8	5.3 c	10.4 b	13.9 b	N/A
Control	18.6	54.5 a	51.3 a	52.7 a	N/A
ANOVA F-value	0.1205	0.0004	0.0023	0.0118	-

* Values are means of three replications. Means followed by the same letter in a column do not significantly differ (P• 0.05, Duncan's New Multiple Range Test).

** Data were log-transformed prior to analysis of variance and the detransformed means are presented here.

*** Data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 2a. Average number of silvertop heads in plots of Barcelona Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.

	Average number silvertop heads/m²*			
Treatment	June 13	June 20	June 27	July 4
CYGON	9.9	52.2	87.4	115.6
DECIS	19.2	24.5	35.3	36.1
Control	14.3	24.7	32.3	35.3
ANOVA F-value	0.8304	0.7527	0.6073	0.3249

Table 2b. Percent silvertop heads and seed yields in plots of Barcelona Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.

	Percent silvertop heads/m²**				
Treatment	June 13	June 20	June 27	July 4	Seed yield (g/4 m²)
CYGON	4.7	29.5	47.7	52.0	2.2
DECIS	32.0	11.7	16.6	17.1	2.1
Control	22.3	38.2	49.0	53.6	1.1
ANOVA F-value	0.4517	0.3420	0.4176	0.3181	0.6097

* Data were log-transformed prior to analysis of variance and the detransformed means are presented here.

** Data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 3a. Average number of silvertop heads in plots of Midnight Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.*

	Average number silvertop heads/m^2**			
Treatment	June 13	June 20	June 27	July 4
CYGON	13.4 a	107.8 a	278.7 a	375.7 a
DECIS	2.0 b	5.7 b	9.0 b	18.7 b
Control	31.7 a	153.9 a	291.9 a	291.9 a
ANOVA F-value	0.0187	0.0004	0.0008	0.0004

Table 3b. Percent silvertop heads and seed yields in plots of Midnight Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.*

	Percent silvertop heads/m^2***				
Treatment	June 13	June 20	June 27	July 4	Seed yield (g/4 m^2)
CYGON	3.8	29.0 a	75.2 a	93.8 a	1.1
DECIS	2.4	2.2 b	3.7 b	7.4 b	4.9
Control	10.6	45.0 a	82.7 a	83.0 a	0.6
ANOVA F-value	0.3026	0.0023	0.0002	0.0006	0.0831

* Values are means of three replications. Means followed by the same letter in a column do not significantly differ (P• 0.05, Duncan's New Multiple Range Test).

** Data were log-transformed prior to analysis of variance and the detransformed means are presented here.

*** Data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 4a. Average number of silvertop heads in plots of Cynthia Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.*

	Average number silvertop heads/m^2**			
Treatment	June 13	June 20	June 27	July 4
CYGON	29.4 b	111.2 a	364.9 a	470.3 a
DECIS	0.6 c	7.7 b	27.0 b	32.6 b
Control	195.4 a	391.0 a	566.7 a	654.6 a
ANOVA F-value	0.005	0.0048	0.0049	0.0044

Table 4b. Percent silvertop heads and seed yields in plots of Cynthia Kentucky bluegrass sprayed three times with two insecticides and assessed on four dates in 1997.*

	Percent silvertop heads/m^2***				
Treatment	June 13	June 20	June 27	July 4	Seed yield (g/4 m^2)
CYGON	4.0 b	15.3 ab	49.2	66.0 a	7.8
DECIS	0.1 b	2.3 b	8.6	9.8 b	4.1
Control	51.2 a	59.8 a	45.6	88.8 a	1.8
ANOVA F-value	0.0149	0.0499	0.0981	0.0027	0.0676

* Values are means of three replications. Means followed by the same letter in column do not significantly differ (P• 0.05, Duncan's New Multiple Range Test).

** Data were log-transformed prior to analysis of variance and the detransformed means are presented here.

*** Data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 5a. Estimated linear relationsips between number of silvertop heads per square meter and sampling date for two insecticide treatments and a control for four Kentucky bluegrass cultivars at Brooks, AB, in 1997.*

Cultivar	Treatment	Regression equation and coefficient of determination (R^2)		Statistical significance for R^2 (P<)
Asset	CYGON	$y = 1.1x - 162$	$R^2 = 0.33$	ns
	DECIS	$y = 0.4x - 64$	$R^2 = 0.47$	0.05
	Control	$y = 0.8x - 107$	$R^2 = 0.17$	ns
Barcelona	CYGON	$y = 5.7x - 913$	$R^2 = 0.43$	0.05
	DECIS	$y = 0.9x - 129$	$R^2 = 0.60$	0.01
	Control	$y = 1.6x - 228$	$R^2 = 0.05$	ns
Cynthia	CYGON	$y = 23.1x - 3775$	$R^2 = 0.83$	0.01
	DECIS	$y = 2.0x - 320$	$R^2 = 0.57$	0.01
	Control	$y = 22.9x - 3540$	$R^2 = 0.73$	0.01
Midnight	CYGON	$y = 17.2x - 2803$	$R^2 = 0.85$	0.01
	DECIS	$y = 0.8x - 130$	$R^2 = 0.53$	0.01
	Control	$y = 12.8x - 2035$	$R^2 = 0.81$	0.01

* Dependent variable (y) = silvertop heads/m², independent variable (x) = sampling (Julian) date.

** $y = mx + b$, where y = dependent variable, m = slope of regression line, x = independent variable, and b = y-axis intercept.

*** ns = non-significant ($P>0.05$)

Table 5b. Estimated linear relationships between percent silvertop heads per square metre and sampling date for two insecticide treatments and a control for four Kentucky bluegrass cultivars at Brooks, AB, in 1997.*

Cultivar	Treatment	Regression equation and coefficient of determination (R^2)		Statistical significance for R^2 (P<)
Asset	CYGON	$y = 1.6x - 234$	$R^2 = 0.64$	0.01
	DECIS	$y = 0.5x - 86$	$R^2 = 0.66$	0.01
	Control	$y = 1.4x - 197$	$R^2 = 0.40$	0.05
Barcelona	CYGON	$y = 2.2x - 358$	$R^2 = 0.35$	0.05
	DECIS	$y = 0.4x - 59$	$R^2 = 0.67$	0.01
	Control	$y = 1.4x - 209$	$R^2 = 0.30$	ns
Cynthia	CYGON	$y = 3.1x -510$	$R^2 = 0.85$	0.01
	DECIS	$y = 0.6x - 94$	$R^2 = 0.39$	0.05
	Control	$y = 1.4x - 180$	$R^2 = 0.19$	ns
Midnight	CYGON	$y = 4.5x - 736$	$R^2 = 0.96$	0.01
	DECIS	$y = 0.3x - 47$	$R^2 = 0.66$	0.01
	Control	$y = 3.6x - 568$	$R^2 = 0.81$	0.01

* Dependent variable (y) = silvertop heads/m², independent variable (x) = sampling (Julian) date.

** $y = mx + b$, where y = dependent variable, m = slope of regression line, x = independent variable, and b = y-axis intercept.

*** ns = non-significant ($P>0.05$)

PMR REPORT # 59 **SECTION E: INSECT PESTS OF CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE: 364-1221-8803

CROP: Spring wheat, cv. Roblin, Domain
PEST: Orange wheat blossom midge, *Sitodiplosis mosellana* (Gehin)

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TITLE: ORANGE WHEAT BLOSSOM MIDGE CONTROL IN SPRING WHEAT WTH IMIDACLOPRID

MATERIALS: BAY NTN 33983 24FS (imidacloprid), GARLIC BARRIER (100% garlic juice), CROCKER'S FISH OIL (98% active fish oil), LORSBAN 4EC (chlorpyrifos)

METHODS: Roblin spring wheat was seeded into soil in plastic cylinders (40 mm diameter by 200 mm in height) in January 1997, and plants were grown in a growth chamber with a 18:6 (LD) photoperiod at 5• C to 25• C until the inflorescence emergence crop growth stage (5 for the cereal growth stage of Zadoks). The plants were then moved to a bioassay room at 20• C with 70% RH and with light conditions that were modified to provide extended dusk-like conditions. Two heads from each of 5 plants were immersed in one of 3 solutions of NTN 33983 that had been prepared in tap water. The treated plants were then added to a cage with a 5 x 5 grid along with 10 untreated plants. Sixty adult males and 106 females of the wheat midge, that had emerged within the past 36 hours, were added to the cage. After 4 days the heads were covered with a pollen bag and plants were moved from the cage to a greenhouse. Heads were cut from the plant at maturity and were examined for larval infestation. In a follow-up study, Domain spring wheat was seeded with a double disc press drill at Glenlea, Manitoba on 3 June 1997. The crop was sown at a rate of 80 kg/ha to a depth of 3 to 4 cm in 17.5 cm row spacings. Plots were 1.25 m by 5.0 m and were replicated 5 times in a randomized complete block design. The treatments were applied 18 July 1997 with a CO2-pressurized backpack sprayer at a water volume of 220 L/ha and a pressure of 300 kPa, using D6-25 nozzles, when wheat plants in the plots were in the inflorescence emergence crop growth stage. Fifteen wheat heads were randomly collected in each plot on 4 September at crop maturity. Five heads per plot were dissected under a microscope and the number of larvae or cast skins on each seed were counted. The number of larvae per wheat head in both tests were analysed by Duncan's Multiple Range test (P=0.05). The percentage of seeds infested in the heads (Y) were transformed by the arcsine • Y.

RESULTS: Data for the laboratory and field studies are contained in Table 1.

CONCLUSIONS: Larval densities amongst NTN 33983 treatments in the laboratory tests did not differ because of high variability between replicates. However, approximate rates for LD50 and LD90 of 25 g/ha and 70 g/ha, respectively, could be estimated by linear regression. The LD50 rate applied in the field study only reduced larval densities by 38%, but efficacy in all treatments, as indicated by the results for the standard LORSBAN, were lower than expected. A combination of very high adult densities at the time of inflorescence emergence and a 1-2 day delay in application timing were likely the cause for these results. A doubling of the LD50 rate for NTN 33983 failed to improve efficacy, or significantly reduce larval densities compared to the CHECK. The combination of garlic juice and fish oil was ineffective against the wheat midge. Only LORSBAN of all the treatments in the field test significantly reduced larval densities.

Table 1. The number of orange wheat blossom midge larvae in spring wheat heads treated with imidacloprid in field and laboratory studies.

Treatments	Rate (g ai/ha)	Larvae/head		% Seed Infestation	
		Lab	Field	Lab	Field
CHECK	-	7.9a	33.3a	60	50.2
NTN 33893	12.5	6.5a	-	31	-
NTN 33983	25	4.8a	20.6ab	24	36.9
NTN 33893	50	2.4a	20.9ab	22	40.0
GARLIC BARRIER + FISH OIL	1% + 1%	-	31.5a	-	48.0
LORSBAN	400	-	12.9b	-	35.5

* Means followed by the same letter are not significantly different (Duncan's MRT, *P*>0.05)

END OF SECTION E

SECTION F - ORNAMENTALS AND GREENHOUSE CROPS /PLANTES ORNEMENTALES ET DE SERRE

- Report/Rapport # 60
- Pages 155-157

Section Editor - Les Shipp

PMR Report # 60 **SECTION F: INSECT PESTS OF ORNAMENTALS AND GREENHOUSE**
STUDY DATA BASE #: 344-1252-8901

CROP: Greenhouse Tomato & Greenhouse Cucumber
PEST: Two-spotted spider mite, *Tetranychus urticae* Koch

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TITLE: **EVALUATION OF FOLIAR APPLICATIONS OF AVID (ABAMECTIN 1.9%EC) AND DYNOMITE (PYRIDABEN 75% WP) FOR CONTROL OF TWO-SPOTTED SPIDER MITES ON GREENHOUSE TOMATO AND GREENHOUSE CUCUMBER**

MATERIALS: AVID (abamectin 1.9% EC); DYNOMITE (pyridaben 75% WP)

METHODS:
Tomato: Tomato seedlings (cv. Trust) were transplanted onto rockwool slabs in greenhouse compartments at the Greenhouse and Processing Crops Research Centre (GPCRC) on August 19, 1996. Nutrition, temperature regimes, and general growing conditions were similar to those for commercial crops. Plants treated with AVID were in a compartment separate from those treated with DYNOMITE. A total of eight high-volume spray applications were made at weekly intervals for each of AVID and DYNOMITE. The first application was made on September 23, five weeks after transplanting, and the last application was made on October 12. Rates of application were the same as those proposed in the Minor Use application. AVID was applied at 300ml/1000L and DYNOMITE at 284g/1000L. A total of

196 plants were used for each pesticide and plants were observed for any phytotoxic effects.

Cucumber: Cucumber seedlings (cv. Flamingo, Corona, Ventura) were transplanted onto rockwool slabs in greenhouse compartments at GPCRC on July 31. Nutrition, temperature regimes, and general growing conditions were similar to those for commercial crops. Plants treated with AVID were in a compartment separate from those treated with DYNOMITE. A total of five high-volume spray applications were made for each pesticide at weekly intervals, beginning August 20 and ending September 16. Rates for AVID and DYNOMITE applied were the same as those on tomatoes. A total of 320 plants were used in this trial and plants were observed for phytotoxic effects.

RESULTS:

A) Phytotoxic Effects - No phytotoxicity was observed on either cucumber or tomato plants throughout the experiment.

B) Efficacy of Avid and Dynomite on Two-Spotted Spider Mites

Laboratory Trial

Spider mites, from a laboratory culture at GPCRC, were placed on tomato leaves that were laid on moist filter paper in petri dishes, and sprayed once in a Potter Tower with AVID (300 ml/1000L) and DYNOMITE (284g/1000L). Distilled water was used as a check. Each pesticide treatment was replicated six times, and each replicate consisted of 10 adult spider mites. The check was replicated three times. The percentage of dead spider mites was recorded at 24 and 48 hours after treatment. Results are shown in Table 1.

Table 1. Average percentage mortality of Two-spotted Spider Mites (TSSM) after application of Avid and Dynomite in a laboratory trial.

Treatment	% Mortality of TSSM after Spray Application	
	24 hr	48 hr
AVID (300ml/1000L)	98	100
DYNOMITE (284g/1000L)	48	87
Control (Water)	7	13

Greenhouse Trials

This trial was conducted in greenhouses at GPCRC using mature tomato (cv. Trust) and cucumber (cv. Flamingo) plants. Two-spotted spider mites were obtained from a laboratory culture, as previously described, and introduced onto the test plants by placing bean leaves infested with spider mites onto the plants for five days. Spider mites were counted on one leaf of each plant and the leaf petioles were rimmed with a sticky material that prevented escape of the mites. Test plants were then sprayed with AVID and DYNOMITE using the rates previously described. Each treatment was replicated eight times. Control plants were sprayed with water. The number of live and dead mites were counted to estimate percentage mortality at 24 and 48 h after application. Mortality was expressed as a percentage, corrected according to the mortality in the control using Abbott's formula (1925) (Table 2).

Table 2. Average percentage mortality of Two-spotted Spider Mites (TSSM) on tomato and cucumber at 24 and 48 hours after one application of Avid (300ml/1000L) and Dynomite (284g/1000L) under greenhouse conditions.

Treatment	% Mortality of TSSM at 24 and 48 h after spray application			
	Cucumber		Tomato	
	24 h	48 h	24 h	48 h
AVID	97	100	97	100
DYNOMITE	80	99	88	99
Control	2	2	0	0

CONCLUSIONS: DYNOMITE and AVID exhibited effective chemical control of two-spotted spider mites at the recommended rates without causing phytotoxic damage to greenhouse cucumbers and tomatoes.

References

Abbott, W. S. 1925. A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology* **18**: 265-267.

END OF SECTION F

SECTION G - BASIC STUDIES/ÉTUDES DE BASE
- Reports/Rapports # 61 - 62
- Pages 158 - 161

Section Editor - Stephanie Hilton

PMR REPORT # 61

SECTION G: BASIC STUDIES (Insects)
STUDY DATA BASE: 306-1261-9019

CROP: Apple cv Red Delicious
PEST: Apple brown bug *Atractotomus mali*

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TITLE: EFFICACY OF MALATHION AGAINST APPLE BROWN BUG

MATERIALS: MALATHION 25 W

METHODS: A bioassay was used to test resistance to Malathion 25W. Tapwater (control) or rates of Malathion 25 W were applied to uniform apple branches (20 cm) using a single nozzle pot sprayer calibrated to deliver 220 L/ha. After the spray had dried, branches (3 each) were transferred to a 125 mL erlenmeyer flask containing water and sealed with aluminum foil, and placed in a 4 L glass jar. *A. mali* nymphs were collected from an orchard block, apple cv Red Delicious, which had received no insecticide application in 1997. Nymphs (5/jar) were transferred to the branches in each 4 L jar. Nymphs were counted as dead when unable to move one body length when prodded gently with a camel hair brush. The number of nymphs alive and dead were counted 24, 48, and 72 hours following transfer to the jars. The experiment was repeated 3 times. Percent mortality was estimated for each rate of MALATHION from a probit znalysis of the data.

RESULTS: MALATHION was effective in controlling apple brown bug nymphs.

CONCLUSIONS: Apple brown bug nymphs tested June 22-28, 1997 showed no evidence of resistance to the recommended rate (3.5 kg/ha) of Malathion 25 W.

Table 1. Estimated percentage mortality of apple brown bug nymphs 24, 48, and 72 h after placement in a 4 L jar containing 3 sprayed apple branches.

Treatment	Rate (kg/ha)	Insects #	% mortality 24 h	48 h	72 h
Malathion	0.018	60	57	74	80
Malathion	0.35	60	66	80	83
Malathion	1.75	60	84	89	96
Malathion	3.5	60	89	92	98

PMR REPORT # 62 **SECTION G: BASIC STUDIES**
STUDY BASE NUMBER: 280-1252-9704

CR0P: Potato
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: SUSCEPTIBILITY OF COLORADO POTATO BEETLE TO ADMIRE AND SEVERAL OTHER INSECTICIDES

MATERIALS: ADMIRE 240 (imidacloprid), technical (>95% purity) imidacloprid, cypermethrin, endosulfan, azinphosmethyl, chlorfenapyr

METHODS: Leaf Dip. Potato leaves were dipped into solutions of varying concentrations of ADMIRE 240F in water and allowed to dry. CPB adults were then placed onto treated foliage. Treated foliage was replaced with fresh untreated foliage after 2 days. Mortality was assessed for 8 days. A discriminating dose was developed that would kill 100% of our laboratory strain (0.005% solution v/v of ADMIRE 240F) within 24 h. Seventeen field-collected populations were evaluated for tolerance to ADMIRE at this dose. Survival of test CPB at this discriminating dose would indicate the development of resistance.
Direct Contact. In a Potter spray tower, 5 ml of varying concentrations of technical (>90% purity) imidacloprid, cypermethrin, endosulfan, azinphosmethyl and chlorfenapyr in 19:1 acetone:olive oil were sprayed directly onto 4 replicates of 10 adult CPB. Four concentrations were selected to kill from 10 to 90% of the treated insects. We then determined the. Results were compared to an insecticide-susceptible (S) strain maintained in the laboratory. This tolerance ratio (LC_{50} field/LC_{50} lab) for each population provided a measure of field resistance.

RESULTS: In the leaf-dip bioassay, all test insects from all 17 CPB populations appeared dead 24 hrs after exposure to foliage treated with the discriminating dose of ADMIRE 240F (0.005% solution). While nearly all test CPB appeared dead for 4 days after exposure to treated foliage, recovery was then noted in 13 of 17 populations, to the extent that for one population, as many as 56% of test CPB had recovered from intoxication by 8 days after initial exposure.

In direct contact bioassays, the ratio of the LC_{50} of imidacloprid of the most tolerant strain to the lab susceptible strain was 4.5x (Table 1). The difference was not statistically significant and reflects natural variability of populations and differences in ages of collected adults. One outlier strain proved more susceptible than the lab strain. If the outlier population is included in calculation, the tolerance ratio for imidacloprid increases to 10x. For cypermethrin, azinphosmethyl and endosulfan, the laboratory CPB strain was most susceptible. Resistance levels declined 66% and 33%, respectively, for cypermethrin and endosulfan in 1997.

CONCLUSIONS: There was no sign of field resistance to ADMIRE® in Ontario CPB or to chlorfenapyr, an experimental insecticide. Resistance to "older" insecticides appears to be decreasing. While increased or more rapid recovery after a period of "intoxication" could presage development of resistance to ADMIRE®, it also complicates design of a rapid field test for resistance detection.

Table 1. Range in susceptibility of 17 populations of Ontario CPB to selected insecticides applied by direct contact, 1997.

Insecticide	Susceptibility Range LC_{50} (% Solution)	Tolerance Ratio*	
		1996	1997
imidacloprid	0.0002 - 0.0009	x 4.4	x 4.5
cypermethrin	0.0023 - 0.05	x 64.0	x 21.7
azinphosmethyl	0.04 - >1.0	x 30.0	x >25.0
endosulfan	0.009 - 1.0	x 166.0	x 111.1
chlorfenapyr	0.027 - 0.11	x 3.0	x 4.1

* least susceptible/most susceptible

END OF SECTION G

END OF INSECT REPORTS

FILE: 97DISEASE.REP **Sections H - M: Reports # 63 - 133; Pages 162 - 345**

PLANT PATHOLOGY/PHYTOPATHOLOGIE

H - Fruit / Fruits
I - Vegetables and Special Crops / Légumes et cultures spéciales
J - Potatoes / Pommes de terre
K - Cereal, Forage and Oilseed Crops / céréales, cultures fourragères et oléagineux
L - Ornamentals, Greenhouses and Turf / plantes ornementales, de serre et de gazon
M - Nematodes / Nématodes

PEST MANAGEMENT METHODS/MÉTHODES DE LUTTE DIRIGÉE

N - Biological control/lutte biologique
  - Weeds/Mauvaises herbes
  - Insects, Mites, Nematodes

SECTION H - PLANT PATHOLOGY/PHYTOPATHOLOGIE
- DISEASES OF FRUIT/ MALADIES DES FRUITS
- Reports/Rapports # 63 - 68
- Pages 162 - 173

Section Editor: Leslie MacDonald

PMR REPORT # 63

SECTION H: DISEASES OF FRUIT
ICAR: 8888030

CROP: Apple, cvs. Braeburn, Fuji
PEST: Blue mold, *Penicillium expansum* Link

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TITLE: EFFECT OF CALCIUM FOLIAGE SPRAYS ON BLUE MOLD OF APPLES IN 1996

MATERIALS: Calcium chloride, CALCIMAX (Calcium 8.0%, Boron 0.5%), NUTRICAL (Calcium 8.0%)

METHODS: The trial was conducted in one Fuji and two Braeburn orchard blocks on trees planted in 1993 in Summerland, B.C. The experimental design was a randomized complete block with six replicates per treatment. Each replicate consisted of 5 trees with trees 1 and 5 serving as guard trees to act as buffers between treatments. All treatments except the control were applied until runoff with a backpack sprayer on August 15, 21, 29, September 5, 12 and 19. Apples were harvested at commercial maturity on October 19-20, and immediately placed in cold storage at 1±0.2• C. Additional apples from the control blocks were pressure infiltrated (103 kPa) with 8% calcium chloride. After storage for 3 months, five apples per treatment replicate were dipped in nutrient broth or nutrient broth containing 10^6 spores/ml of *Penicillium expansum.* The dipped apples were wounded in three locations in a triangular pattern approximately 2 cm apart with a 2.5 mm diameter nail to a depth of 3 mm. The fruit were incubated at 20 • C for 6 days at which time blue mold rot diameters were recorded by measuring each wound in two directions and recording the average of the two measurements. The decay diameter data were analysed with the general linear models procedure (SAS Institute, Cary, NC) and means were separated with the LSD multiple comparison test. Calcium content was determined by taking a random sample of 25 fruit from each treatment replicate, removing stems and seeds and blending unpeeled quarters with 1.5 times their weight of distilled water. A 150 ml subsample was further homogenized with a high-speed tissue homogenizer. A weighted 9 ml aliquot of homogenized slurry was digested in 5.4 ml of concentrated sulphuric acid. Calcium was determined on the extracts via atomic absorption spectroscopy. Calcium data were analysed as above except the Duncan's multiple range test was used.

RESULTS: Pressure infiltration with 80 g/L calcium chloride reduced the rot area an average of 49.3% in both Braeburn and Fuji apples. Foliar sprays with calcium chloride, CALCIMAX, and NUTRICAL did not reduce decay area in apples inoculated with *P. expansum* but did reduce decay in apples that were dipped in broth where only the natural inoculum was present. Fruit sprayed with calcium chloride contained the highest concentration of calcium when compared to the other two foliar sprays but this did not result in reduced decay area in the calcium chloride sprayed fruit.

CONCLUSIONS: Pressure infiltration or foliar sprays with materials containing calcium are beneficial in reducing blue mold rot area in stored Braeburn and Fuji apples.

Table 1. Effect of calcium infiltration and calcium foliar sprays on blue mold rot diameter (mm)

Treatment	Rate	Braeburn Location 1			Breaburn Location 2			Fuji Location 2		
		Pen. Dip*	Broth Dip	Ca**	Pen. Dip	Broth Dip	Ca	Pen. Dip	Broth Dip	Ca
Calcimax	4.5 ml/L	23.8b ***	5.5b	4.9b	22.8b	3.5b	4.1c	20.7b	6.2b	5.5b
utrical	4.5 ml/L	24.3b	6.6b	5.5b	22.8b	5.3b	4.7b	19.6	6.9b	5.7b
Calcium chloride	5.0 g/L	23.8b	4.7b	6.7a	23.0b	3.9b	5.8a	20.2b	8.6b	6.8a
Cacl$_2$ infiltration	80.0 g/L	12.0a			9.4a			11.3a		
Check	---	23.6b	10.8a	5.1b	22.8b	7.8a	4.2c	19.9b	9.1a	5.6b

* Pen Dip indicates that the apples were dipped in a spore suspension of 1 x 10^6 spores/ml of *Penicillium expansum* and Broth Dip indicates that the apples were dipped in a sterile nutrient broth solution.

** Ca indicates the calcium content of the apples based on mg/100g fresh weight.

*** Means within a column, followed by different letters, are significantly different (P• 0.05), according to the LSD test or Duncan's mutiple range test for calcium contents.

PMR REPORT # 64

SECTION H: DISEASES OF FRUIT
STUDY DATA BASE: 390 1252 9201

CROP: Highbush Blueberry (*Vaccinium corymbosum*)
PEST: Mummy Berry, *Monilinia vaccinii-corymbosi*

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TITLE: EFFICACY OF TOPAS FOR THE CONTROL OF MUMMY BERRY IN HIGHBUSH BLUEBERRIES

MATERIALS: TOPAS (Propiconazole 250 g/l)

METHODS: The trial was conducted in 1997 on a commercial blueberry field known to be infected with mummy berry. Blueberry rows were spaced 3 m apart. Plants were spaced 60 cm apart within the row. Each treatment was applied to 2 m x 3 m plots replicated four times in a randomized complete block. Only the middle two bushes within each plot were assessed. Two untreated bushes at either end of each plot were left as a buffer between each treatment. The treatments were applied with a pressured backpack sprayer in 1000L/ha of water. Three rates of TOPAS were tested: 62.5, 125 and 190 g ai/ha. Sprays were applied either 2, 3 or 4 times on the following dates; March 25 (flower bud swell), April 2 (vegetative bud swell), May 8 (early blossom stage) and May 24 (full bloom). Primary (ascospore) infection was assessed on May 15 and 16, by counting the number of blighted flower clusters. The fourth spray had not been appled at this time. Green berries were harvested on June 30, cut open and examined for the presence of hyphal growth in the seed cavity to assess the mummy berry (conidia) infection stage of the disease. Data were subjected to Anova.

RESULTS: Primary infection was reduced by all TOPAS treatments, The untreated check had the highest rate of secondary infection. There was a trend for TOPAS to reduce secondary infection. TOPAS 62.5 g ai/ha applied 4 times and all TOPAS 190 g ai/ha treatments significantly reduced secondary infection.

CONCLUSIONS: Overall mummy berry infection was low in 1997, possibly due to the cool spring weather. Blossom development was delayed by approximately three weeks in 1997. TOPAS can significantly reduce mummy berry infection. There was no indication of any phytotoxicity.

TABLE 1. Number of mummy berry infected blossom clusters and green berries treated with three rates of TOPAS and three spray regimes in 1997.*

Treatment	Rate	Number of sprays	Number of blighted blossom clusters May 15, 16	Number of infected berries out of 200 harvested
untreated check	-	-	15.8 a	11.8 a
TOPAS	62.5 g ai/ha	2	8.8 b	9.0 ab
TOPAS	62.5 g ai/ha	3	5.3 b	7.3 ab
TOPAS	62.5 g ai/ha	4	5.5 b	4.8 b
TOPAS	125 g ai/ha	2	4.3 b	8.5 ab
TOPAS	125 g ai/ha	3	6.5 b	7.0 ab
TOPAS	125 g ai/ha	4	5.5 b	7.3 ab
TOPAS	190 g ai/ha	2	4.0 b	5.8 b
TOPAS	190 g ai/ha	3	3.5 b	5.5 b
TOPAS	190 g ai/ha	4	5.8 b	5.3 b

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P 0.05).

PMR REPORT # 65 **SECTION H: DISEASES OF FRUIT**
ICAR: 8888030

CROP: Grape, cv. Pinot noir (clone 93 Ritter)
PEST: Powdery mildew, *Uncinula necator* (Schwein) Burrill

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TITLE: EFFICACY OF ICIA5504 AGAINST POWDERY MILDEW ON GRAPE, 1996

MATERIALS: ICIA5504 (Azoxystrobin), MAESTRO 75 DG (Captan), YF9836 Bond Adjuvant

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 6 year old vines. Spacing was 1.5 x 3.0 m (vine by row). The cordon trained, spur pruned vines (ca. 20 nodes/m row) on 5C rootstocks with vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with six replicates. Each 5-vine replicate had vines 1and 5 as guards, thus treatments were separated by 2-vine buffers. The five treatments were applied until run-off with a handgun operated at approximately 600 kPa. Fungicides were applied according to an anti-resistance strategy. ICIA5504 treatments were alternated with MAESTRO at 74.8 g/100 L after two consecutive ICIA5504 treatments. ICIA5504 and NOVA were applied on June 13, June 27, August 6 and August 20, and MAESTRO and NOVA were applied on July 16 and September 4. Ten leaves on each of four shoots per vine were evaluated for incidence of powdery mildew on September 20 at first sign of powdery mildew and again at harvest on October 22. In addition at harvest five canes and 10 clusters per vine were evaluated for powdery mildew. These counts were converted to the percent infected per replicate, arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan K-ratio t-test was used at K = 100, which approximates p = 0.05 for multiple comparison of means and estimation of the minimum significant difference between means.

RESULTS: As presented in the table.

CONCLUSIONS: ICIA5504 is an effective material for the control of grape powdery mildew in British Columbia. It was as effective as NOVA on grape foliage and clusters. However it was less effective than NOVA, unless combined with MAESTRO in preventing cane powdery mildew. A possible reason could be because powdery mildew developed very late in the season (September 20). Possibly ICIA5504 was not able to protect the canes this long. The last application of ICIA5504 had been made on August 20 compared to September 4 for NOVA.

Table 1. Percent powdery mildew on Pinot noir grape leaves, canes and clusters.

Treatment	Rate of Product/100 L	Leaves Sept. 20	Leaves Oct. 22	Canes Oct. 22	Clusters Oct. 22
1. ICIA5504 80WG +	8.4 g	0.3b**	1.9b	21.4ab	1.6b
YF9836 Bond Adjuvant*	0.125 L				
2. ICIA5504 80WG +	10.4	1.4b	1.4b	24.7ab	1.6b
YF9836 Bond Adjuvant*	0.125 L				
3. ICIA5504 80WG+	8.4 g	0.3b	0.5b	17.1b	1.2b
YF9836 Bond Adjuvant +	0.125 L				
MAESTRO 75 DG*	54.8 g				
4. NOVA 40WP	6.6 g	0.3b	0.5b	2.4b	2.1b
5. CONTROL	---	41.0a	17.2a	53.6a	9.1a
ANOVA		P• 0.0001	P• 0.0013	P• 0.0136	P• 0.0045

* These treatments were applied two times in succession followed by MAESTRO 75DG at 74.8 g/100 L then two more times in succession followed by MAESTRO 75DG.

** These data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Figures are the means of 6 replications. Numbers followed by the same letter are not significantly different at p = 0.05 as decided by the Waller-Duncan K-ratio t-test.

PMR REPORT # 66 **SECTION H: DISEASES OF FRUIT**
ICAR: 8888030

CROP: Grape, cv. Johannesburg Riesling (clone 21B Weis)
PEST: Powdery mildew, *Uncinula necator* (Schwein) Burrill

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TITLE: EFFICACY OF BAS 490F AGAINST POWDERY MILDEW ON GRAPE, 1996

MATERIALS: BAS 490 02F 50WG (kresoxim-methyl), KUMULUS S 80 WDG (sulphur), NOVA 40 WP (myclobutanil)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 7 year old vines. Spacing was 2.0 m x 3.0 m (row x vine). The cordon trained, spur pruned (20 nodes/m row), own rooted vines with vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 5-vine replicate with vines 1 and 5 as guards were separated by 2-vine buffers. The five treatments were applied until run-off with a handgun operated at approximately 600 kPa. The treatments were applied on June 13, June 27, July 16, August 6, August 20 and September 4. Ten leaves on each of four shoots per vine were evaluated for incidence of powdery mildew on September 23 at first sign of disease and again at harvest on October 23. In addition at harvest five canes per vine and 10 clusters per vine were evaluated. These counts were converted to the percent infected per replicate, arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan, K-ratio t-test was used at $K = 100$, which approximates $p = 0.05$ for multiple comparison of means and estimation of the minimum significant difference between means.

RESULTS: As presented in the table.

CONCLUSIONS: All rates of BAS 490 F and NOVA controlled grape powdery mildew. Disease development occurred very late and was light especially on leaves and clusters. Possibly if disease incidence would have been earlier and higher the lower rate of BAS 490F would not have been effective. It appeared that BAS 490F at the 4.0 g rate was beginning to lose control on the canes.

Table 1. Percent powdery mildew on Riesling grape leaves, canes and clusters.

Treatment	Rate of Product /100L water	Leaves		Canes	Clusters
		Sept. 23	Oct. 23		
BAS 490F 50 WG	4.0 g	0.3b*	0.4b	5.8b	1.2b
BAS 490F 50 WG	6.0 g	0.3b	0.3b	3.4b	1.2b
BAS 490F 50 WG	8.0 g	0.3b	0.3b	3.4b	1.2b
NOVA 40 WP	6.8 g	0.3b	0.3b	3.4b	1.2b
CONTROL	-	3.6a	6.6a	63.7a	12.6a
ANOVA		P• 0.0002	P• 0.05	P• 0.0001	P• 0.0001

* These data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Figures are the means of 5 replications. Numbers followed by the same letter are not significantly different at p = 0.05 as decided by the Waller-Duncan K-ratio t-test.

PMR REPORT # 67 **SECTION H: DISEASES**
ICAR: 8888030

CROP: Peach (*Prunus persica* (L.) Batsch), cvs. Glohaven and Harbrite
PEST: Brown rot, *Monilinia fructicola* (Wint.) Honey

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TITLE: USE OF CHLOROTHALONIL FOR CONTROL OF BROWN ROT IN 1997

MATERIALS: BRAVO 500 (chlorothalonil 40.0% flowable), BRAVO WEATHER STIK (chlorothalonil 40.4% flowable), BENLATE 50WP (benomyl 50% WP), MAESTRO 75DF (captan 75% DF)

METHODS: The trials were conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. in two separate orchard blocks consisting of 12 mature Glohaven and 9 mature Harbrite trees. The experimental design was a randomized complete block with treatments replicated three times on single tree replicates. The treatments were applied until run-off with a handgun operated at 345 kPa on May 2, May 9 and May 16. The final treatment was applied on August 13 just 2 days before harvest. Number of blighted blossoms were counted on May 22 by visually examining each tree for withered blossoms. Fruit brown rot was assessed at harvest and again 10 days later on fruit incubated at 20• C. These counts were converted to percent infected fruit and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range test was used for multiple comparison of means.

RESULTS: Blossom blight did not occur on Glohaven or Harbrite peaches in 1997. Fruit brown rot did occur at harvest but the number of infected fruit were low and did not differ significantly between the treatments (Table 1). When the Glohavens were incubated at 20• C for 10 days, 45.7% of the control fruit were infected. Less decay occurred in the treated fruit although the differences were not significant. After 10 days there was significantly less decay in Harbrites treated with BRAVO 500 than control fruit.

CONCLUSIONS: BRAVO 500 and BRAVO WEATHER STIK will reduce brown rot in peach fruit if disease pressure is not too high.

Table 1. Percent fruit brown rot on Glohaven and Harbrite peaches sprayed with three fungicides (BRAVO 500, BRAVO WEATHER STIK and ROVRAL)

Treatment	Rate of product /100 L	Glohavens Harvest	Glohavens After 10 d	Harbrites Harvest	Harbrites After 10 d
BRAVO 500	187 ml	3.2a*	22.7a	0.0a	2.0 b
WEATHER STIK	130 ml	5.0a	25.0a	0.0a	3.7ab
ROVRAL	62.5 g	3.3a	22.3a	---	---
CONTROL	---	3.3a	45.7a	2.7a	7.7a
ANOVA		NS	NS	NS	P• 0.09

* Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by Duncan's Multiple Range Test.

PMR REPORT # 68 **SECTION H: DISEASES OF FRUIT**
STUDY DATA BASE: 390 1252 9201

CROP: Raspberry, cv. Tulameen
PEST: Raspberry root rot, *Phytophthora fragariae* var. *rubi*

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TITLE: EFFICACY OF RIDOMIL AND RIDOMIL GOLD AGAINST RASPBERRY ROOT ROT, 1997

MATERIALS: RIDOMIL (metalaxyl 240 g/l), RIDOMIL GOLD (metalaxyl 480 g/l).

METHODS: As a followup of the 1996 PMR Report #78, a trial was conducted on the raspberry variety, Tulameen, on an established raspberry farm at Langley, B.C. There was a natural infestation of root rot. The raspberry rows were spaced 3 m apart. Each treatment was applied to 9.5 m x 1 m plots with 4 replications in a randomized block design. The treatments were applied as drenches in 2000 L/ha water with a pressurized sprayer. Treatments were applied October 22, 1996. Measurements were taken on Aug 18 and 19 for sucker height and diameters. Yield data is based on harvests taken from June 30 to July 16. Marketable and cull weight and size index (based on gram weight of 50 berries) were recorded. Fruiting canes were counted and weighed following harvest.

RESULTS: Results for Ridomil and Ridomil Gold are similar.

CONCLUSIONS: There is a trend for better yield and cane growth with the Ridomil and Ridomil Gold treatments.

Table 1. A comparison of marketable yield (yld), size index, fruiting cane weight(wt) and fruiting cane number(no) per plot in Tulameen raspberries sprayed with RIDOMIL and RIDOMIL GOLD.*

Treatments	Rate (prod/100 m row)	Market yld (g)	Size Index (g wt of 50 berries)	fruit cane wt kg	fruit cane no
Check	---	4084.5a	135.0a	8.1a	28.2a
RIDOMIL	150 ml	4628.2a	137.0a	9.4a	34.0a
RIDOMIL GOLD	37 ml	4796.7a	136.2a	9.3a	33.8a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. A comparison of sucker height (ht), sucker diameter (diam) sucker number (no) in Tulameen raspberries sprayed with RIDOMIL and RIDOMIL GOLD.*

Treatments	Rate (prod/100 m row)	Sucker ht (cm)	Sucker diam (mm)	sucker no
Check	---	195.7a	7.2a	62.8a
RIDOMIL	150 ml	198.8a	7.5a	68.1a
RIDOMIL GOLD	37 ml	201.6a	7.6a	66.0a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

END OF SECTION H

SECTION I - VEGETABLES AND SPECIAL CROPS / LÉGUMES ET CULTURES SPÉCIALES

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- Pages 174 - 261

Section Editor - Ray Cerkauskas

PMR REPORT # 69

SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS
ICAR #: 206003

CROP: Carrot cv. Six Pak
PEST: Sclerotinia rot (*Sclerotinia sclerotiorum* Lib de Bary)

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TITLE: EVALUATION OF FUNGICIDES AND CALCIUM FOR THE CONTROL OF SCLEROTINIA ON CARROTS IN STORAGE, 1996/97

MATERIALS: BENLATE 50WP (benomyl) CALCIUM NITRATE 15.5% (calcium 19%) BRAVO 500 (chlorothalanil 50%) LIME (dolomitic)

METHODS: Carrots were direct seeded (96 seeds/m) in organic soil naturally infested with the fungus (pH 6.4, organic matter 60%) at the Muck Crops Research Station on 30 May, 1996. A randomized complete block arrangement was used. Each replicate consisted of four raised beds (85 cm apart), 5 m in length. There were six field treatments: BENLATE 50WP at 1.1kg/ha; BRAVO 500 at 3.2 L/ha; LIME at 6.7 t/ha; CALCIUM NITRATE at 0.1, 1.0, 10.0% Ca. An untreated check was also included. LIME was broadcasted pre-plant and worked into the soil. BENLATE 50WP was applied on 10, 20 Sep and 7 Oct approximately 51, 41 and 24 days before harvest. CALCIUM NITRATE and BRAVO 500 were applied on 19 Sep, and 4, 11 and 17 Oct between 42 and 14 days before harvest. All treatments were applied as foliar spray at 100 psi (boom) using a pull type plot sprayer with D2 solid cone nozzles in 500 L/ha of water. Carrots were harvested from the two inner rows of each plot on 31 Oct, 1996. Treatments were placed in storage after harvest. Twelve-half bushels (approx. 250 kg) were harvested on 4 Nov, 1996 from the untreated check plots. These carrots were washed and dipped for 30 seconds in one of four solutions: BENLATE 50WP at 2.2 g/L water, CALCIUM NITRATE at 0.01%, 0.1% and 1.0% Ca in solution. An untreated check wash was also included. All samples were placed in 25 kg plastic containers and put in a Filacell storage where the temperatures and relative humidity were kept approximately 1°C and 95% respectively. The number of carrots with and without visible white mold (sclerotinia) were counted on 22 and 23 Jan 1997 and 16 May 1997. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Differences were found between method of application on both assessment dates, but few differences were found among treatments. When disease was assessed in Jan 97 no treatments reduced infection compared to the unwashed (field) check. However, Benlate 50WP as a drench controlled disease was better as compared to the washed check. By May 1997, disease on the washed checks had increased considerably, but none of the treatments effectively reduced infection compared to the unwashed (fields) check.

Table 1. Control of Sclerotinia on Carrots in storage in 1996-97.

Treatments	Rate		Percent Disease			
	Field application kg/ha product	Post harvest drench product g/L H_20	Jan 97		May 97	
			Field	Drench	Field	Drench
Field check			1.4 a		8.9 a	
Field washed check			6.2 a		45.5 e	
Washed check				20.4 d c		23.0 c-f
CALCIUM 0.01%		0.515		22.8 d		22.9 c-f
CALCIUM 0.1%	14.7	5.15	3.6 a	14.6 c	10.9 a b	29.9 d e f
CALCIUM 1.0%	147.1	51.5	3.7 a	17.0 d c	15.7 c d e	38. 7 e f
CALCIUM 10.0%	147.1		3.1 a		15.8 c d e	
BRAVO 500	3.2		2.4 a		9.0 a	
BENLATE 50WP	1.1	2.2	1.4 a	5.4 a	7.3 a	39.2 f
LIME	6.7 t/ha		3.3 a		13.3 c d e	

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD test.

PMR REPORT # 70 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**

ICAR#: 206003

CROP: Carrots cv 'Lucky B'
PEST: Alternaria Leaf Blight (*Alternaria dauci* Kuhn)

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TITLE: EFFICACY OF FUNGICIDE PENNCOZEB 75 DF FOR CONTROL OF ALTERNARIA LEAF BLIGHT OF CARROTS, 1997

MATERIALS: PENNCOZEB 75DF (mancozeb 75%), BRAVO 500 (chlorothalonil 50%), DITHANE DG (mancozeb 75%), ZINEB 80WP (zineb 80%)

METHODS: Carrots were seeded (65 seeds/m) into organic soil naturally infested with the fungus (pH 6.4, organic matter 60%) at the Muck Crops Research Station on 19 Jun, 1997. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of foour raised beds (86 cm apart), 5 m in length. PENNCOZEB 75DF was applied singly at 2.25 kg/ha on 13 and 26 Aug. BRAVO 500 at
3.0 L/ha was added to the PENNCOZEB 75DF (2.25 kg/ha) on the last two sprays of 8 and 16 Sep. The conventional treatments (sprayed as recommended in Pub. 363 1996/97) were DITHANE DG (2.25 kg/ha) BRAVO 500 (3.0 L/ha), ZINEB 80WP (2.25 kg/ha), and DITHANE DG (2.25 kg/ha), applied on 13 and 26 Aug and 8 and 16 Sep, respectively. An untreated check was also included. The treatments were applied using a pull type plot sprayer with TeeJet D-3 hollow cone nozzles at 100 psi (boom) at 500 L/ha of water. On 24 Oct an overall visual blight rating of each replicate was taken. Forty leaves and petioles were randomly sampled and the number of infected leaves and/or petioles were counted. A visual rating of % blight was also taken on the 40 sampled leaves. A harvest of sample 2.32 m of row was also taken. Data were analyzed using the General Analysis of Variance of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant (P=0.05) differences were found among treatments for field visual blight ratings. The control had the lowest rating (2.25) with noticeable infected leaves and petioles plus dead leaves. The conventional treatment had more noticeable blight on the leaves and petioles than the PENNCOZEB 75 DF which was greener. No significant differences were found among any of the treatments for percent green tissue, percent petiole infection and harvest yield. The PENNCOZEB 75 DF had the higher percent green tissue (96.5%) than the conventional (94.0%) and control (92.5%). The lowest percent petiole infection was PENNCOZEB 75DF (17%) while both conventional and control had mid 30's percent. Although yield difference among the treatment were not significant chemical treatments PENNCOZEB 75DF (13.24 kg) and conventional (13.0 kg) were higher than the control at 7.87 kg).

Table 1. Evaluation of PENNCOZEB 75DF for the control of Alternaria leaf blight on carrots, 1997.

Treatment	Field Visual Blight Rating*	% Green Tissue	% Petioles Infection	Harvest Yield (kg 2.32 m)
Control	2.25 c **	92.5 a	33 a	7.87 a
Conventional	3.9 b	94.0 a	39 a	13.00 a
PENNCOZEB 75DF at 2.25 kg/ha (4 sprays) + BRAVO 500 at 3.0 L/ha (last 2 sprays)	4.4 a	96.5 a	17 a	13.24 a

* 0 = Severe, tops completely rotted. 3.7 = Moderate, lesions on leaves and petioles. 5.0 = Healthy, no lesions.

** Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 71 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR#: 206003

CROP: Celery cv Florida 683
PEST: Septoria Late Blight (*Septoria apiicola*)

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TITLE: EVALUATION OF THE FUNGICIDES FOR CONTROL OF SEPTORIA LATE BLIGHT OF CELERY, 1997.

MATERIALS: TOPAZ (25% propiconazole), PENNCOZEB 75DF (mancozeb 75%), BRAVO 500 (chlorothalonil 50%), BRAVO ZN (tetrachloroisophthalonitrile 38.5 %) FLUAZINAM 500F (fluazinam 50%) and BRAVO 825 (tetrachloroisophthalonitrile 82.5%)

METHODS: Celery was seeded into Plastomer plug trays (200 cells/tray) on 15 May 1997 and thinned to one plant per cell on 20 Jun. Once thinned, 50% of the plants were inoculated with a spore suspension of *Septoria apiicola* conidia, prepared by immersing 50 g of dried diseased celery leaves in 1 L of distilled water for 24 hours and filtering it through a fine mesh sieve (30) on 30 Jun and 16 Jul using a bottle sprayer. The celery was transplanted on 18 Jul. Three consecutive rows per replicate had healthy plants, 3 consecutive rows had inoculated plants. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 6 rows (55 cm apart, 5 m in length). Field spraying began once the disease had spread to the healthy plants. Treatments were applied on 15, 23, Sep and 3, 8 Oct using a pull type plot sprayer with TeeJet D-3 hollow cone nozzles at 100 psi (boom) and 500 L/ha of water. Visual ratings of percentage of leaves infected with Septoria late blight was taken on 22 Oct. Harvest yields of 20 plants and percentage of petioles with Septoria late blight were also taken. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Blight infection was severe in this plot. There were no significant differences among treatments in visual blight ratings. BRAVO ZN at 4.0 L/ha resulted in the highest yield and the longest average length, while none of the other fungicide treatments were significantly different from the untreated control.

Table 1. Evaluation of foliar applied fungicides for the control of celery Septoria blight

Treatment	Field Visual * Blight Rating	% Petioles Infected	Average Plant Length (cm)	Harvest Yield 20 plants (kg)
Control	3.3 a **	72 a	46.6 b	12.42 b
TOPAZ at 295 ml/ha	3.7 a	82 a	53.4 ab	15.86 ab
PENNCOZEB 75DF at 2.25 kg/ha (+ BRAVO 500 at 3.0 L/ha last 2 sprays)	3.6 a	75 a	53.0 ab	14.27 ab
TOPAZ at 125 ml/ha + BRAVO 500 at 1.6 L/ha	3.9 a	84 a	50.9 ab	14.17 ab
BRAVO ZN at 4.0 L/ha	3.6 a	74 a	55.1 a	17.12 a
FLUAZINAM at 1.0 L/ha	3.4 a	80 a	50.8 ab	13.27 b
BRAVO 825 at 2.4 kg/ha	3.2 a	89 a	48.1 ab	9.23 b

* 1.0 = dead plant. 3.7 = 30% leaves showing disease. 5.0 = no disease.

** Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 72 **SECTION I:** **DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.),
cv. Marango (Desi type), cvs. Sanford and UC27 (Kabuli type)
PEST: Pythium root rot, *Pythium ultimum* Trow, *P. irregulare* Buisman

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF PYTHIUM ROOT ROT ON CHICKPEA

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL), APRON FL(metalaxyl 317 g/L SN)

METHODS: Field plot experiments were established at two sites, Vegreville and Brooks, Alberta in the spring of 1996 and 1997. Chickpea cv. Marango (Desi type) and cv. Sanford (Kabuli type, 1996), and UC27 (Kabuli type, 1997) were planted 4 cm deep on May 21 and May 23, 1996 and May 23 and May 28, 1997 at Brooks and Vegreville, respectively, using 40 seeds/row in 1996 and 50 seeds/row in 1997. A peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodulating bacteria. *Pythium ultimum* and *P. irregulare* inoculum was mixed and incorporated with the seed at the rate of 40 mL/row. Each plot consisted of four, 6 m rows at Brooks, and 4 m rows at Vegreville, with a 25 cm row spacing. Adjacent plots were separated by 0.4 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. Treatments consisted of: CROWN (UBI 2521) at 12 + APRON at 0.32 g/kg seed; CROWN at 6 + APRON at 0.32 mL/kg seed; APRON at 0.64 mL/kg seed; APRON at 0.32 mL/kg seed, and an untreated control with and without the *P. ultimum - P. irregulare* inoculum mixture. Seedling emergence was counted three weeks after seeding at Brooks on four, 6m rows and 2 weeks after seeding in Vegreville on four, 4 m rows. Chickpeas were harvested in Brooks on October 15, 1996 and Sept. 25, 1997. In Vegreville, the plots were destroyed by Ascochyta foliar blight in both years and could not be harvested. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: At Vegreville in 1996, all fungicidal treatments, except for CROWN + APRON applied to cv. Marango at the lower rate, significantly (P• 0.05) improved seedling emergence compared to the inoculated control (Table 1). All fungicidal treatments significantly improved seedling emergence for the

Kabuli type and fungicidal treatments containing CROWN improved seedling emergence for the Desi type in 1997. The heavier application of CROWN produced higher seedling emergence in Kabuli chickpeas in 1997 than those treated with APRON, and in 1996, it produced higher seedling emergence than in plots treated with the lighter application of APRON. At Brooks, all fungicidal seed treatments significantly increased emergence for the Desi type, but not for the Kabuli type compared to the inoculated control in 1996 (Table 2). The reverse trend occurred in 1997 (Table 3). All of the seed treatments significantly improved the yield of the Kabuli type in 1996, and all but the heavier application of CROWN produced significantly higher yield than the untreated control in 1997. No significant yield differences were observed between treatments for the Desi type in either year.

CONCLUSIONS: The results from both sites show improvement in emergence with application of some fungicidal seed treatments. Without fungicidal seed treatments, Kabuli type chickpeas were much more susceptible to *Pythium* than the Desi type.

Table 1. Effect of seed treatment on percent germination of chickpea types Desi and Kabuli at Vegreville, Alberta in 1996 and 1997*.

Treatment	Rate (mL/kg seed)	Germination (%)			
		1996		1997	
		Desi	Kabuli	Desi	Kabuli
CROWN + APRON + P•	12 + 0.32	81.3 a	81.1 a	53.8 a	66.8 a
CROWN + APRON + P	6 + 0.32	69.9 ab	84.3 a	55.6 a	62.2 ab
APRON + P	0.64	80.1 a	79.6 ab	52.2 ab	49.2 c
APRON + P	0.32	76.3 a	73.9 b	50.4 ab	55.2 bc
Control + P		59.5 b	1.0 c	43.0 bc	0.0 d
Control - P		72.5 a	0.9 c	36.6 c	0.0 d

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

• Denotes inoculation with *Pythium ultimum-P. irregulare* mixture.

Table 2. Effect of seed treatment on percent germination and yield of chickpea types Desi and Kabuli at Brooks, Alberta in 1996*.

Treatment	Rate (mL/kg seed)	Desi		Kabuli	
		Germ (%)	Yield (g/6m²)	Germ (%)	Yield (g/6m²)
CROWN + APRON+ P•	12 +0.32	83.5 a	68.0 a	44.9 a	142.6 b
CROWN + APRON+ P	6 + 0.32	86.5 a	46.6 a	65.9 a	390.0 a
APRON + P	0.64	83.0 a	94.0 a	65.7 a	186.2 b
APRON + P	0.32	79.5 a	38.3 a	41.3 a	232.7 b
Control + P		75.6 b	21.4 a	58.4 a	0.0 c
Control - P		84.4 a	45.2 a	62.9 a	0.0 c

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

- Denotes inoculation with *Pythium ultimum-P. irregulare* mixture.

Table 3. Effect of seed treatment on percent germination and yield of chickpea types Desi and Kabuli at Brooks, Alberta in 1997*.

Treatment	Rate (mL/kg seed)	Desi		Kabuli	
		Germ (%)	Yield (g/6m²)	Germ (%)	Yield (g/6m²)
CROWN + APRON + P•	12 + 0.32	40.6 b	1000.0 a	48.2 a	752.5 ab
CROWN + APRON + P	6 + 0.32	36.0 b	972.5 a	45.2 a	962.5 a
APRON + P	0.64	39.0 b	1055.0 a	45.0 a	892.5 a
APRON + P	0.32	47.6 b	1060.0 a	50.2 a	1017.5 a
Control + P		44.2 b	872.5 a	5.6 b	367.5 b
Control - P		70.8 a	1230.0 a	14.8 b	407.5 b

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

- Denotes inoculation with *Pythium ultimum-P. irregulare* mixture.

PMR REPORT # 73 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), common type Desi
PEST: Fusarium root rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF FUSARIUM ROOT ROT ON CHICKPEA

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL), APRON FL (metalaxyl 317 g/L SN)

METHODS: Field plot experiments were established at two sites, Vegreville and Brooks, Alberta in the spring of 1997. Desi type chickpea was planted 4 cm deep on June 2 and May 29 at Brooks and Vegreville, respectively, using 50 seeds/row. A peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodulating bacteria. Inoculum consisting of *Fusarium avenaceum* was incorporated with the seed at a rate of 20 mL/row. Each plot consisted of two, 6 m rows at Brooks, and four, 4 m rows at Vegreville, with a 25 cm row spacing. Adjacent plots were separated by 0.4 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. Treatments consisted of: CROWN (UBI 2521) at 6 + APRON at 0.32 mL/kg seed; CROWN at 3 + APRON at 0.32 mL/kg seed; APRON at 0.32 mL/kg seed, and an untreated control with and without *Fusarium* inoculum. Seedling emergence was counted on June 23 at Brooks on two, 6m rows and on June 12 at Vegreville on four, 4m rows. Chickpeas were harvested in Brooks on Sept. 25. In Vegreville, the plots were destroyed by Ascochyta foliar blight and could not be harvested. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: At Vegreville, all fungicidal treatments significantly (P• 0.05) improved seedling emergence relative to the *Fusarium* treatment, and plots treated with CROWN at the lower rate had significantly better seedling emergence than those treated at the higher rate (Table 1). At Brooks, fungicidal seed treatments that included CROWN significantly increased seedling emergence over treatment with APRON alone and over plots without fungicidal seed treatment. Similar trends occurred in seed yield, although no significant differences were observed among fungicidal seed treatments.

CONCLUSIONS: The results from both sites showed improvement in seedling emergence and seed yield when fungicidal seed treatments that included CROWN were used. APRON alone was effective at Vegreville, but not at Brooks.

Table 1. Effect of seed treatment on number of seedlings and seed yield of chickpea at Brooks and Vegreville, Alberta, 1997*.

Treatment	Rate mL/kg	Brooks		Vegreville
		Plants/6 m	Yield (g/6 m^2)	Plants/4 m
CROWN + APRON + F•	6 + 0.32	33.75 a	977.5 a	21.86 b
CROWN + APRON + F	3 + 0.32	34.38 a	1012.5 a	25.25 a
APRON + F	0.32	22.88 b	872.5 ab	22.50 ab
Control (Uninoculated)		22.63 b	780.0 b	23.44 ab
Fusarium (F)		23.88 b	805.0 b	14.25 c

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

• Denotes inoculation with *Fusarium avenaceum*

PMR REPORT# 74 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Sanford (Kabuli type)
PEST: Botrytis blight, *Botrytis cinerea*

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS BLIGHT ON CHICKPEA

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL), APRON FL (metalaxyl 317 g/L SN)

METHODS: Field plot experiments were established at two sites, Brooks and Vegreville, Alberta in spring, 1997. Two *Botrytis*-infested seedlots of kabuli type chickpea cv. Sanford were planted 4 cm deep on June 2 and May 28 at Brooks and Vegreville, respectively, using 50 seeds/row. A peat-based inoculant (Enfix-P^{TM}) at 30 mL/row was used as a source of root-nodulating bacteria. Each plot consisted of four, 6 m rows at Brooks, and 4 m rows at Vegreville, with a 25 cm row spacing. Adjacent plots were separated by 0.4 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. Treatments consisted of: CROWN (UBI 2521) at 6 + APRON at 0.16 g/kg seed; CROWN at 3 + APRON at 0.16 mL/kg seed; APRON at 0.16 mL/kg seed, and an untreated control. Seedling emergence was counted June 23 at Brooks on two 6m rows and June 18 at Vegreville on two 4m rows. Chickpeas were harvested in Brooks on Sept. 25. In Vegreville, the plants were destroyed by Ascochyta foliar blight and therefore could not be harvested. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: At Vegreville, the fungicidal treatments significantly (P• 0.05) improved seedling emergence for both seedlots (Table 1). At Brooks, the high concentration of CROWN + APRON did not improve emergence over the control, but the other fungicide treatments did. Seedlot #1 showed significantly higher seed yield than the untreated control where seeds were treated with APRON or with APRON + CROWN at the lower concentration.

CONCLUSIONS: The results from both sites show improved emergence when infected chickpea seed was treated with APRON alone, and APRON + CROWN at the lower concentration. CROWN applied with APRON did not improve emergence of *Botrytis*-infested seed, relative to APRON applied alone.

Table 1. Effect of seed treatment on seedling emergence and seed yield of chickpea cv. Sanford at Brooks and Vegreville, Alberta in 1997*.

		Brooks				Vegreville	
		Seedlot 1		Seedlot 2		No. plants/4m	
Treatment	Rate (mL/kg)	No. plants/ 6 m	Yield (g/6 m^2)	No. plants/ 6m	Yield (g/6 m^2)	Seedlot 1	Seedlot 2
CROWN + APRON	3+0.16	23.88 ab	827.5 a	29.50 a	922.5 a	28.38 a	26.38 a
CROWN + APRON	6+0.16	18.75 bc	725.0 ab	22.10 ab	807.5 a	26.88 a	25.25 a
APRON	0.16	29.25 a	972.5 a	30.25 a	892.5 a	24.75 a	26.25 a
CONTROL		10.38 c	565.0 b	21.13 b	726.3 a	4.00 b	2.25 b

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

PMR REPORT # 75 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**

ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cvs. Sanford, UC 27 (Kabuli type)
PEST: Ascochyta blight, *Ascochyta rabiei* (Pass.) Lab.

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TITLE: EFFICACY OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF ASCOCHYTA SEEDLING BLIGHT ON CHICKPEA

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL), APRON FL (metalaxyl 317 g/L SN)

METHODS: Field plots were established at two sites, Vegreville and Brooks, Alberta in the spring of 1996 and 1997. Ascochyta-infected seeds (approx. 30% infection) of cv. Sanford chickpea were planted 4 cm deep on May 22 and 23, 1996 at Brooks and Vegreville, respectively, using 40 seeds/row. In 1997, two lots (96-057 and 97-171) of Kabuli type (UC 27) chickpea seeds naturally infested with *A. rabiei* were planted on May 22 at both sites using 50 seeds/row. A peat-based inoculant (Enfix-P^{TM}) at 30 mL/row was used as a source of root-nodulating bacteria. Each plot consisted of four, 6 m rows at Brooks, and 4 m rows at Vegreville, with a 25 cm row spacing. Adjacent plots were separated by 0.4 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. Treatments were applied to seeds using a Hege small batch seed treater. Treatments consisted of: CROWN (UBI 2521) at 6 + APRON at 0.32 mL/kg seed; APRON at 0.32 mL/kg seed, and an untreated control. Seedling emergence was counted three weeks after seeding at Brooks on two, 6 m plots and at Vegreville on two, 4 m rows. Chickpea were harvested at Brooks on October 15, 1996 and September 11, 1997. A severe infestation of Ascochyta blight (*A. rabiei*) prevented harvest at Vegreville in both years. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Both fungicidal treatments showed significantly (P• 0.05) greater seedling emergence than the untreated control at both Vegreville and Brooks (Table 1). The treatment using CROWN + APRON had greater seedling emergence than the treatment using APRON alone at Vegreville in 1996.

CONCLUSIONS: The results from both sites indicated that APRON provided effective protection against soilborne pathogens. When combined with CROWN, the treatment showed higher seedling survival at Vegreville in 1996, indicating that CROWN had the potential to provide additional protection against seed- and soil-borne diseases.

Table 1. Effect of seed treatment on seedling viability of chickpea infected with Ascochyta blight at Brooks and Vegreville, Alberta, 1996 and 1997*.

		Survival (%) - 1996		Survival (%) - 1997			
		Sanford		96-057/UC 27		97-171/UC27	
Treatment	Rate (mL/kg)	Brooks	Vegreville	Brooks	Vegreville	Brooks	Vegreville
CROWN + APRON	8 + 0.32	95.6 a	80.9 a	85.8 a	74.1 a	71.7 a	77.4 a
APRON	0.32	91.6 a	63.8 b	86.6 a	74.8 a	86.5 a	76.6 a
Control		6.3 b	0.9 c	22.2 b	1.3 b	8.8 b	0.0 b

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

REPORT # 76

SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS
STUDY DATA BASE: 375-1122-9612

CROP: Chickpea
PEST: Ascochyta blight [*Didymella rabiei*, anamorph *Ascochyta rabiei*]

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TITLE: FUNGICIDES REDUCE ASCOCHYTA BLIGHT SEVERITY IN CHICKPEA, 1996 AND 1997.

MATERIALS: QUADRIS (azoxystrobin, 250 g/l), BRAVO 500 (chlorothalonil, 50% F)

METHODS: The efficacy of fungicides for management of ascochyta blight of chickpea was evaluated in two trials each year at the Saskatoon Research Centre farm at Saskatoon, SK in 1996 and 1997. Each trial consisted of six replicates in a randomized complete block design. Each plot consisted of 8 rows, 3 m in length, with 0.3 m between rows. Four rows of barley were planted between plots to reduce interplot interference. One trial in each year was sown to cv. Sanford, a partially resistant kabuli-type chickpea; the other to cv. Arizonia, a susceptible desi chickpea. The trials were seeded adjacent to one another each year. Sanford was seeded on 28-29 May, 1996 and 23 May, 1997, and Arizonia on 07 June, 1996 and 02 June, 1997. Differences in seeding date were imposed to synchronize the flowering and subsequent development of the two cultivars. The plots were inoculated on 23 July and 08 August 1996 and 03 July 1997 with infected chickpea residue collected each spring from a site with severe ascochyta blight on chickpea the previous year. There were 12 treatments in each trial: two rates of BRAVO (1.0 and 1.5 kg ai/ha) applied one, two or three times, two rates of QUADRIS (125 and 250 gai/ha) applied one or two times, an untreated control; and a positive control (1997 only), where BRAVO at 1.0 kg ai/ha was applied at 10-14 day intervals from the first treatment date until mid-September.

In 1996, the first fungicide application was made on 14 August (mid bloom); subsequent applications, where required, were made on 27 August (late bloom) and 04 September (pod filling), respectively. Whole-plot ratings of blight severity (% leaf area affected) were made using the Horsfall-Barrett scale on 21 August and 09 September, and 8 m^2 of each plot was harvested on 9-10 October. Three replicates of the Sanford trial and two of the Arizonia trial were abandoned due to plant loss associated with late spring flooding. In 1997, fungicides were applied on 16 July (early bloom), 23 July (mid-bloom) and 01 August (late bloom). Severity ratings were made on 18 July, 07 and 25 August. Desiccant (Reglone Pro) was applied on 25 September and the plots were harvested on 2-4 October.

RESULTS: Fungicide application reduced blight severity late in the season (Table 1), based on single df contrasts against the untreated control. In Sanford, this reduction was small and did not translate into measurable yield increases. In Arizonia, the impact on severity was large, but yields were affected only in 1997. Even then, one application did not increase seed yield; two (or more) applications increased yield by as much as 65% (QUADRIS at 250 gai) over a single application. There were no treatment effects in the earliest disease rating in 1997 (mean 3% of leaf area affected in Sanford, 35% in Arizonia), so these data are not presented.

CONCLUSIONS: In four station years of testing, foliar applications of BRAVO and QUADRIS were equally effective in reducing the severity of ascochyta blight on chickpea. In the partially resistant cultivar Sanford, blight control with fungicide was not required to maintain yield. In Arizonia (susceptible), the disease affected more than 70% of the leaf area in the controls during pod filling each year. In 1996, the epidemic did not develop until mid-August, then increased very rapidly. Fungicide treatments, which had been delayed until the appearance of symptoms, went on after the disease was already well established throughout the trial, which was too late to provide optimum disease control. In 1997, the epidemic started earlier, developed more slowly, and continued over a longer period. With longer exposure to blight pressure, more than one fungicide application was required to maintain disease control until harvest. The situation in 1997 is more typical of ascochyta blight development in Saskatchewan, and so multiple applications of BRAVO or QUADRIS will be required to maximize yield of susceptible chickpea cultivars in fields where ascochyta blight is present.

Table 1. Disease severity (% leaf area affected) of ascochyta blight [*Didymella rabiei*] and seed yield ('000s kg/ha) of two chickpea cultivars in inoculated field trials at Saskatoon, SK in 1996 and 1997.

		1996			1997		
	Timing of	Disease Severity (%)		Yield	Disease Severity (%)		Yield
Treatment	application*	21 Aug	09 Sept	(T/ha)	07 Aug	25 Aug	(T/ha)
Arizona (susceptible)							
Untreated control		50	70	2.3	45	73	0.8
Positive control	1, 2, 3+	-	-	-	30	22	1.0
BRAVO at 1.0 kg ai/ha	1	59	28	2.5	36	63	0.9
" "	1, 2	73	28	2.3	28	43	1.0
" "	1, 2, 3	62	40	2.3	32	43	1.1
BRAVO at 1.5 kg ai/ha	1	72	45	2.3	27	75	0.8
" "	1, 2	66	50	2.2	24	42	1.2
" "	1, 2, 3	61	45	2.5	23	32	1.1
QUADRIS at 125 gai/ha	1	44	45	2.6	33	68	0.9
" "	1, 2	66	45	2.5	32	36	0.9
QUADRIS at 250 gai/ha	1	62	33	2.5	44	68	0.8
" "	1, 2	62	34	2.5	28	26	1.3
Mean		**62**	**42**	**2.4**	**32**	**49**	**1.0**
LSD (0.05)		**NS**	**23.0**	**NS**	**NS**	**21**	**0.36**
Sanford (partially resistant)							
Untreated control		17	13	2.5	4	8	1.8
Positive control	1, 2, 3+	-	-	-	4	5	1.5
BRAVO at 1.0 kg ai/ha	1	13	4	1.8	6	6	1.5
" "	1, 2	18	5	1.7	4	5	1.6
" "	1, 2, 3	15	3	2.0	4	4	1.4
BRAVO at 1.5 kg ai/ha	1	14	5	2.3	4	8	1.8
" "	1, 2	13	4	1.7	4	5	1.4
" "	1, 2, 3	15	4	2.0	4	6	1.7
QUADRIS at 125 gai/ha	1	10	4	1.9	4	4	1.3
" "	1, 2	18	6	2.4	4	5	1.4
QUADRIS at 250 gai/ha	1	5	5	2.4	4	3	1.4
" "	1, 2	9	6	2.7	4	4	1.5
Mean		**13**	**5**	**2.1**	**4**	**5**	**1.5**
LSD (0.05)		**NS**	**2.0**	**NS**	**NS**	**NS**	**NS**

* Timing of application corresponds approximately to 1) mid bloom, 2) late bloom and 3)pod set in 1996, and 1) early bloom, 2) mid and 3) late bloom in 1997.

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PMR REPORT # 77 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.),cvs. Othello (pinto), NW63 (red mexican), US1140 (great northern), Viva (pink), UI906 (black) and Mitchell (navy)
PEST: None

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TITLE: EFFECTS OF CHEMICAL SEED TREATMENTS ON EMERGENCE, UNIFORMITY, VIGOUR AND NODULATION IN SIX TYPES OF DRY BEANS IN GREENHOUSE AND LABORATORY TRIALS AT BROOKS, ALBERTA IN 1996

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulfate 62.6% WP; equivalent to 50% streptomycin base), CAPTAN 400 (captan 37.4% SU), THIRAM 75 WP (thiram 75% WP)

METHODS: Three separate experiments were set up to assess potential phytotoxic effects of two fungicides, CAPTAN and THIRAM, alone or in combination with the bactericide AGRICULTURAL STREPTOMYCIN, on six types of dry beans (pinto, red mexican, great northern, pink, black and navy) at CDC South. These experiments assessed: 1) bean emergence and growth under greenhouse conditions, 2) germination and radicle length under laboratory conditions, and 3) nodule development under greenhouse conditions. Each experiment consisted of a randomized complete block design with nine treatments and six replications. Eight chemical treatments, which were comprised of one rate each for CAPTAN 400 and THIRAM 75 WP alone and three rates of AGRICULTURAL STREPTOMYCIN in combination with one rate each for CAPTAN 400 and THIRAM 75 WP, were evaluated. An untreated check was included for comparison. Two millilitres of each single or dual chemical treatment was applied as a slurry to a 200 g lot of bean seed and mixed with a Gustafson Batch Lab Treater. Before each treatment, 200 g of seed was run through the treater to pre-coat the drum with the respective fungicide in order to minimize adhesion losses in subsequent batches. The treated seed was handled as follows:
Experiment 1 - Twenty treated or untreated seeds were planted in individual plastic pots (15 cm diameter) of non-pasteurized, sandy loam soil. Pots were arranged on the greenhouse bench in a randomized complete block design. Percent emergence and subjective vigour and uniformity ratings (1-4 scales) were made after a minimum of 10 days (Tables 1-6). For vigour assessments, all pots were visually segregated into four groups based on size of leaves and average plant height, i.e. rating group 1 contained the least robust plants and group 4 the most robust. For uniformity rating, plants were assigned to the following groups based on visual appearance: 1 = <25% of the plants had uniform height and leaf size, 2 = 25-50% were uniform, 3 = 50-75% were uniform, and 4 = >75% were uniform.
Experiment 2 - Twenty treated or untreated seeds were placed on moistened filter paper in glass petri plates (15 cm diameter) and incubated in a dark environmental chamber at 22• C and 90% relative

humidity. Percent emergence and average root lengths (cm) were determined after a minimum of 4 days (Tables 7-12).

Experiment 3 - Twenty treated or untreated seeds were mixed with 0.2 g of *Rhizobium* inoculant (Nitragin Powder® , LiphaTech, Milwaukee, WI) before planting in pots of non-pasteurized, sandy loam soil. Pots were placed in a greenhouse for 5-6 weeks, then nodulation ratings (1-4 scale, where 1 = poor and 4 = very good) were taken on all of the plants (Tables 13-18).

Data were tabulated and subjected to ANOVA using the Pesticide Research Manager Program. A probability level of • 0.05 was considered significant in the statistical evaluation of treatments and in mean separation tests using Duncan's Multiple Range Test.

RESULTS:

Experiment 1 - No significant differences (P• 0.05) were observed for emergence, vigour and uniformity among treatments for five of the six bean types (Table 1-5). The exception was the navy beans (Table 6), where the untreated check had significantly fewer emerged plants and lower vigour compared to some of the chemical treatments.

Experiment 2 - No significant differences (P• 0.05) between treatments were seen in the red mexican, great northern and black beans (Tables 8, 9, 11). Significantly higher levels of emergence were seen in the untreated check compared to most of the other treatments in the pinto and navy beans (Tables 7, 12). Average root lengths for the untreated pink beans were significantly less than for most of the chemical treatments (Table 10).

Experiment 3 - With the exception of the navy beans (Table 18a), no significant differences (P• 0.05) in average nodulation ratings were observed amongst the six bean types (Tables 13a, 14a, 15a, 16a, 17a). Nodulation in plants grown from CAPTAN-treated navy bean seed was significantly poorer than from THIRAM-treated seed. Nodulation rating data also revealed significant differences between CAPTAN 400 and THIRAM 75 WP for the navy beans (Table 18b). A higher proportion of the plants grown from THIRAM-treated seed exhibited good or very good nodulation compared to the CAPTAN treatment. No significant differences in percentages of plants in the four nodulation categories were observed for the other five bean types (Tables 13b, 14b, 15b, 16b, 17b).

CONCLUSIONS: The eight chemical seed treatment regimes evaluated in these trials generally had negligible effects on bean emergence and growth under both greenhouse and laboratory conditions. There was a slight negative effect of the different fungicides on nodulation. The navy bean was the only type to demonstrate significantly higher levels of nodulation for the THIRAM- versus CAPTAN-containing treatments. No significant differences were observed amongst the other bean types, but all of them seemed to show a slight increase in nodulation with THIRAM seed treatment.

Table 1. Emergence, vigour and uniformity of Othello pinto dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in a greenhouse trial at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Vigour (1-4)	Uniformity (1-4)
CAPTAN 400	2.0 mL	95.9	3.5	3.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	92.0	3.8	3.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	92.6	3.8	3.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	89.1	3.7	3.2
THIRAM 75 WP	1.0 g	90.4	3.5	3.3
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	87.9	3.5	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	86.3	3.3	2.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	88.2	3.0	2.7
UNTREATED CHECK		88.8	3.5	2.8
ANOVA (P• 0.05)		ns	ns	ns
Coefficient of Variation (%)		3.8	19.8	16.9

* The values in this table are the means of six replications. Readings were taken • 10 days after planting. Emergence data were square root transformed before ANOVA and the detransformed means are presented here.

Table 2. Emergence, vigour and uniformity of NW63 red mexican dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in a greenhouse trial at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Vigour (1-4)	Uniformity (1-4)
CAPTAN 400	2.0 mL	88.8	4.0	3.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	85.4	4.0	3.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	91.3	4.0	3.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	94.2	4.0	3.2
THIRAM 75 WP	1.0 g	88.8	4.0	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	88.2	4.0	3.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	90.4	4.0	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	90.4	4.0	3.2
UNTREATED CHECK		79.0	4.0	3.0
ANOVA (P• 0.05)		ns	ns	ns
Coefficient of Variation (%)		5.0	0.0	16.5

* The values in this table are the means of six replications. Readings were taken • 10 days after planting. Emergence data were square root transformed before ANOVA and the detransformed means are presented here.

Table 3. Emergence, vigour and uniformity of US1140 great northern dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in a greenhouse trial at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Vigour (1-4)	Uniformity (1-4)
CAPTAN 400	2.0 mL	89.5	4.0	3.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	85.8	4.0	2.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	84.2	3.8	3.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	86.0	4.0	3.2
THIRAM 75 WP	1.0 g	78.6	3.8	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	88.9	3.8	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	91.0	3.7	2.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	88.3	4.0	2.8
UNTREATED CHECK		81.8	3.3	2.5
ANOVA (P• 0.05)		ns	ns	ns
Coefficient of Variation (%)		11.4	9.6	16.5

* The values in this table are the means of six replications. Readings were taken • 10 days after planting. Emergence data were arcsin transformed before ANOVA and the detransformed means are presented here.

Table 4. Emergence, vigour and uniformity of Viva pink dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in a greenhouse trial at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Vigour (1-4)	Uniformity (1-4)
CAPTAN 400	2.0 mL	90.7	3.5	2.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	91.7	3.5	2.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	91.7	3.8	2.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	92.6	3.8	3.0
THIRAM 75 WP	1.0 g	89.8	4.0	3.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	86.9	3.3	2.5
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	87.2	3.7	2.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	93.3	3.7	2.7
UNTREATED CHECK		92.3	3.8	2.7
ANOVA (P• 0.05)		ns	ns	ns
Coefficient of Variation (%)		4.1	12.4	17.9

* The values in this table are the means of six replications. Readings were taken • 10 days after planting. Emergence data were square root transformed before ANOVA and the detransformed means are presented here.

Table 5. Emergence, vigour and uniformity of UI906 black dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in a greenhouse trial at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Vigour (1-4)	Uniformity (1-4)
CAPTAN 400	2.0 mL	93.9	4.0	3.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	96.9	4.0	3.5
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	93.3	4.0	3.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	95.9	3.7	3.0
THIRAM 75 WP	1.0 g	88.8	3.8	2.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	93.9	4.0	2.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	93.3	3.8	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	90.1	3.5	2.8
UNTREATED CHECK		92.9	4.0	3.0
ANOVA (P• 0.05)		ns	ns	ns
Coefficient of Variation (%)		3.0	9.8	20.3

* The values in this table are the means of six replications. Readings were taken • 10 days after planting. Emergence data were square root transformed before ANOVA and the detransformed means are presented here.

Table 6. Emergence, vigour and uniformity of Mitchell navy dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in a greenhouse trial at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Vigour (1-4)	Uniformity (1-4)
CAPTAN 400	2.0 mL	97.8 abc	3.3 bc	3.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	99.9 a	3.0 c	3.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	100 a	3.3 bc	3.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	97.5 abc	3.2 bc	3.2
THIRAM 75 WP	1.0 g	99.2 ab	4.0 a	3.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	99.7 ab	3.5 abc	3.3
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	94.9 bc	3.7 ab	3.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	99.2 ab	3.3 bc	2.8
UNTREATED CHECK		91.6 c	3.3 bc	3.0
ANOVA (P• 0.05)		s	s	ns
Coefficient of Variation (%)		9.1	13.6	15.3

* The values in this table are the means of six replications. Readings were taken • 10 days after planting. Emergence data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 7. Emergence and average root length of Othello pinto dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in blotter tests at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Average root length (cm)
CAPTAN 400	2.0 mL	53.4 c	3.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	51.7 c	3.7
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	61.1 bc	4.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	50.0 c	3.6
THIRAM 75 WP	1.0 g	74.2 b	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	67.9 bc	4.1
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	74.6 b	3.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	69.6 bc	4.1
UNTREATED CHECK		91.9 a	3.8
ANOVA (P• 0.05)		s	ns
Coefficient of Variation (%)		16.9	25.7

* The values in this table are the means of six replications. Readings were taken • 4 days after plating. Emergence data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 8. Emergence and average root length of NW63 red mexican dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in blotter tests at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Average root length (cm)
CAPTAN 400	2.0 mL	98.4	4.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	98.7	4.7
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	96.7	4.4
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	95.7	4.5
THIRAM 75 WP	1.0 g	93.7	5.1
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	97.9	5.4
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	97.9	5.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	92.7	5.1
UNTREATED CHECK		99.9	5.2
ANOVA (P• 0.05)		ns	ns
Coefficient of Variation (%)		8.7	17.4

* The values in this table are the means of six replications. Readings were taken • 4 days after plating. Emergence data were arcsin transformed before ANOVA and the detransformed means are presented here.

Table 9. Emergence and average root length of US1140 great northern dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in blotter tests at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Average root length (cm)
CAPTAN 400	2.0 mL	78.7 a	5.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	80.5 a	5.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	78.1 a	5.6
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	74.9 a	5.1
THIRAM 75 WP	1.0 g	77.8 a	6.4
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	74.3 a	6.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	79.9 a	6.4
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	75.5 a	6.1
UNTREATED CHECK		74.9 a	4.4
ANOVA (P• 0.05)		ns	ns
Coefficient of Variation (%)		5.9	12.7

* The values in this table are the means of six replications. Readings were taken • 4 days after plating. Emergence data were square root transformed and average root length data were log transformed before ANOVA. The detransformed means for both variables are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 10. Emergence and average root length of Viva pink dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in blotter tests at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Average root length (cm)
CAPTAN 400	2.0 mL	91.7	3.8 a
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	83.2	3.9 a
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	85.7	4.3 a
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	85.1	4.3 a
THIRAM 75 WP	1.0 g	85.1	4.2 a
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	81.4	3.7 ab
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	87.2	4.4 a
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	89.7	3.6 ab
UNTREATED CHECK		89.8	2.9 b
ANOVA (P• 0.05)		ns	s
Coefficient of Variation (%)		5.5	16.8

* The values in this table are the means six replications. Readings were taken • 4 days after plating. Emergence data were square root transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 11. Emergence and root length of UI906 black dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in blotter tests at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Average root length (cm)
CAPTAN 400	2.0 mL	98.9	5.7
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	95.3	6.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	97.5	5.9
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	97.8	5.5
THIRAM 75 WP	1.0 g	94.0	5.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	98.7	6.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	95.2	6.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	94.6	5.1
UNTREATED CHECK		99.9	6.3
ANOVA (P• 0.05)		ns	ns
Coefficient of Variation (%)		10.7	18.6

* The values in this table are the means of six replications. Readings were taken • 4 days after plating. Emergence data were arcsin transformed before ANOVA and the detransformed means are represented here.

Table 12. Emergence and average root length of Mitchell navy dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in blotter tests at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Average root length (cm)
CAPTAN 400	2.0 mL	83.9 b	4.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	83.1 b	4.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	85.9 b	4.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	82.8 b	3.6
THIRAM 75 WP	1.0 g	92.8 ab	3.9
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	82.9 b	4.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	88.9 b	4.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	92.0 ab	4.0
UNTREATED CHECK		98.4 a	4.2
ANOVA (P• 0.05)		s	ns
Coefficient of Variation (%)		12.5	14.6

* The values in this table are the means six replications. Readings were taken • 4 days after plating. Emergence data were arcsin root transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 13(a). Root nodulation ratings for Othello pinto dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (1-4)**
CAPTAN 400	2.0 mL	2.6
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	2.4
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	2.5
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	2.7
THIRAM 75 WP	1.0 g	2.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	2.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	2.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	2.6
UNTREATED CHECK		2.8
ANOVA (P• 0.05)		ns
Coefficient of Variation (%)		15.0

* The values in this table are the means of six replications.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 13(b). Percentage of nodulated Othello pinto dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

		Nodulation (% plants per category)**			
Treatment	Rate of product /kg seed	1	2	3	4
CAPTAN 400	2.0 mL	6.4	25.2	60.7	1.9
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	7.3	42.2	43.0	1.1
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	12.9	36.9	35.8	7.3
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	8.4	24.5	47.2	10.8
THIRAM 75 WP	1.0 g	5.3	32.9	40.7	12.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	9.6	30.3	44.7	4.3
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	11.8	26.7	43.2	12.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	9.1	27.1	44.5	11.6
UNTREATED CHECK		8.3	19.2	53.8	12.9
ANOVA (P• 0.05)		ns	ns	ns	ns
Coefficient of Variation (%)		57.9	23.7	34.9	70.3

* The values in this table are the means of six replications. Percentage values for ratings 1, 2 and 4 were square root transformed before ANOVA and detransformed means are presented here.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 14(a). Root nodulation ratings for NW63 red mexican dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (1-4)**
CAPTAN 400	2.0 mL	1.6
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	1.5
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	1.5
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	1.6
THIRAM 75 WP	1.0 g	1.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	1.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	1.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	1.6
UNTREATED CHECK		1.7
ANOVA (P• 0.05)		ns
Coefficient of Variation (%)		13.8

* The values in this table are the means of six replications.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 14(b). Percentage of nodulated NW63 red mexican dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

		Nodulation (% plants per category)**			
Treatment	Rate of product /kg seed	1	2	3	4
CAPTAN 400	2.0 mL	41.3	54.5	1.0	0.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	53.5	47.1	0.8	0.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	49.2	44.8	0.6	0.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	47.1	49.0	0.5	0.0
THIRAM 75 WP	1.0 g	33.9	56.8	5.1	0.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	40.2	49.4	1.6	0.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	42.4	53.0	1.7	0.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	37.9	56.0	1.7	0.0
UNTREATED CHECK		33.9	55.3	5.6	0.0
ANOVA (P• 0.05)		ns	ns	ns	ns
Coefficient of Variation (%)		23.5	17.8	86.9	0

* The values in this table are the means of six replications. Percentage values for ratings 1, 2 and 3 were square root transformed before ANOVA and the detransformed means are presented here.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 15(a). Root nodulation ratings for US1140 great northern dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (1-4)**
CAPTAN 400	2.0 mL	2.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	2.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	2.4
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	2.2
THIRAM 75 WP	1.0 g	2.4
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	2.3
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	2.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	2.1
UNTREATED CHECK		2.1
ANOVA (P• 0.05)		ns
Coefficient of Variation (%)		13.8

* The values in this table are the means of six replications.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 15(b). Percentage of nodulated US1140 great northern dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

		Nodulation (% plants per category)**			
Treatment	Rate of product /kg seed	1	2	3	4
CAPTAN 400	2.0 mL	17.0	43.3	35.1	4.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	21.3	42.5	29.8	4.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	11.8	45.7	30.3	3.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	29.4	31.3	25.5	4.0
THIRAM 75 WP	1.0 g	15.8	32.7	29.9	3.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	15.8	43.0	26.4	3.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	25.0	35.8	29.0	3.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	25.0	43.0	28.1	4.0
UNTREATED CHECK		35.7	27.3	24.2	3.3
ANOVA (P• 0.05)		ns	ns	ns	ns
Coefficient of Variation (%)		35.9	29.5	18.8	5.2

* The values in this table are the means of six replications. Percentage values for ratings 1 and 3 were square root transformed while rate 4 was arcsin transformed before ANOVA and the detransformed means are presented here.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 16(a). Root nodulation ratings for Viva pink dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (1-4)**
CAPTAN 400	2.0 mL	2.5
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	2.4
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	2.4
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	2.4
THIRAM 75 WP	1.0 g	2.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	2.4
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	2.5
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	2.8
UNTREATED CHECK		2.6
ANOVA (P• 0.05)		ns
Coefficient of Variation (%)		12.8

* The values in this table are the means of six replications.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 16(b). Percentage of nodulated Viva pink dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (% plants per category)**			
		1	2	3	4
CAPTAN 400	2.0 mL	16.0	32.4	34.2	9.7
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	17.4	35.7	34.3	6.6
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	12.2	45.3	31.0	6.1
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	17.8	31.0	34.7	9.5
THIRAM 75 WP	1.0 g	12.8	34.5	30.8	17.6
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	18.3	33.5	34.3	12.3
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	17.0	25.9	39.0	12.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	7.2	28.7	37.7	23.0
UNTREATED CHECK		10.1	32.8	33.2	18.7
ANOVA (P• 0.05)		ns	ns	ns	ns
Coefficient of Variation (%)		40.7	16.5	35.4	44.5

* The values in this table are the means of six replications. Percentage values for ratings 1, 2 and 4 were square root transformed before ANOVA and the detransformed means are presented here.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 17(a). Root nodulation ratings for UI906 black dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.

Treatment	Rate of product /kg seed	Nodulation (1-4)**
CAPTAN 400	2.0 mL	3.1
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	2.8
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	3.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	2.9
THIRAM 75 WP	1.0 g	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	3.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	3.2
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	2.7
UNTREATED CHECK		3.1
ANOVA (P• 0.05)		ns
Coefficient of Variation (%)		9.6

* The values in this table are the means of six replications.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 17(b). Percentage of nodulated UI906 black dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (% plants per category)**			
		1	2	3	4
CAPTAN 400	2.0 mL	8.3	9.8	51.1	32.2
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	6.3	25.1	33.1	21.0
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	7.8	12.6	37.9	34.1
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	6.7	30.6	40.2	24.2
THIRAM 75 WP	1.0 g	5.7	8.6	46.7	24.0
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	6.4	18.2	40.9	30.7
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	4.7	10.7	35.5	41.8
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	8.0	22.3	42.8	14.3
UNTREATED CHECK		1.7	17.5	44.8	30.1
ANOVA (P• 0.05)		ns	ns	ns	ns
Coefficient of Variation (%)		65.9	28.8	15.7	30.4

* The values in this table are the means of six replications. Percentage values for ratings 1, 3 and 4 were square root transformed while rate 2 was log transformed before ANOVA and the detransformed means are presented here.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting.

Table 18(a). Root nodulation ratings for Mitchell navy dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (1-4)**
CAPTAN 400	2.0 mL	1.7 cd
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	1.7 cd
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	1.6 cd
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	2.0 bc
THIRAM 75 WP	1.0 g	2.3 a
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	2.4 a
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	2.3 a
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	2.3 a
UNTREATED CHECK		2.2 ab
ANOVA (P• 0.05)		s
Coefficient of Variation (%)		13.0

* The values in this table are the means of six replications.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting. Numbers within the column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

Table 18(b). Percentage of nodulated Mitchell navy dry beans grown from seed treated with either CAPTAN 400 or THIRAM 75 WP fungicide and three rates of AGRICULTURAL STREPTOMYCIN in greenhouse trials at Brooks, Alberta in 1996.*

Treatment	Rate of product /kg seed	Nodulation (% plants per category)**			
		1	2	3	4
CAPTAN 400	2.0 mL	43.7 a	29.4	14.1 bc	0.0 c
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.2 g	34.5 ab	47.2	7.2 c	0.4 bc
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 0.4 g	45.4 a	31.9	10.9 c	0.0 c
CAPTAN 400 + AGRICULTURAL STREPTOMYCIN	2.0 mL + 1.0 g	33.1 ab	33.1	28.1 ab	0.4 bc
THIRAM 75 WP	1.0 g	22.3 bc	24.1	40.9 a	3.8 ab
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.2 g	19.0 c	27.2	37.5 a	6.1 a
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 0.4 g	21.4 bc	29.4	39.4 a	2.4 abc
THIRAM 75 WP + AGRICULTURAL STREPTOMYCIN	1.0 g + 1.0 g	18.2 c	30.6	37.7 a	6.4 a
UNTREATED CHECK		24.1 bc	33.1	41.1 a	0.4 bc
ANOVA (P• 0.05)		s	ns	s	s
Coefficient of Variation (%)		12.3	10.6	26.2	115.6

* The values in this table are the means of six replications. Percentage values for ratings 1, 2 and 4 were log transformed while rating 3 was square root transformed before ANOVA and the detransformed means are presented here.

** Nodulation rating: 1 = none, 2 = fair, 3 = good, 4 = very good. Data were taken 5-6 weeks after planting. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

CROP: Dry beans (*Phaseolus vulgaris*), cv. Othello
PEST: Sclerotinia, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: EFFICACY OF SELECTED FUNGICIDES FOR CONTROL OF SCLEROTINIA ON DRY BEANS

MATERIALS: BENLATE (benomyl 50WP), BRAVO ZN (chlorothalonil 500g/L), IB11923 (ISK BioSciences experimental)

METHODS: The experiment was conducted in 1997 at Portage la Prairie, Manitoba with an RCB design. The naturally infested plot area was prepared with 2.46 kg/ha of Edge DC herbicide and 70-40-20-10-5 kg/ha of N-P_2O_5-K-S-Zn fertilizer incorporated prior to seeding. Beans were sown on June 4 at 45 kg/ha, 2.5 cm deep and in rows 30 cm apart. Plots were 4 m by 7 m in area and consisted of 4 rows of which the centre two rows were treated and harvested. Treatment application was made to each plot on July 24 at 75% bloom using drop nozzles mounted on a bicycle sprayer equipped as a drop-nozzle band sprayer. TXVS8 cone nozzles delivering 200 L/ha at 275 kPa were used with CO_2 as the propellant. Product rates for the treatments were BENLATE at 1.753 kg/ha, BRAVO ZN at 2.47 L/ha, and IB11923 at 2.47 L/ha. A tankmix treatment of BRAVO ZN and BENLATE, at their respective rates, was also included in the experiment. Plants (stems and pods) in each plot were evaluated for incidence of sclerotinia on August 12 (19 days after treatment) and August 27 (34 days after treatment). Data was analyzed using PRM 4.

RESULTS: Results are summarized in Table 1. On the first evaluation date, incidence of sclerotinia was significantly ($P<0.05$) higher on beans in the untreated control compared to all treatments except BRAVO ZN. IB11923-treated plants had the lowest disease incidence. By the second evaluation date, the incidence of sclerotinia had increased in all plots. The untreated and the Bravo Zn had significantly higher disease levels than all other treatments. IB11923 still had the lowest disease level although not significantly lower than Benlate. Yield differences reflected the disease incidence evaluations. Untreated beans and the BRAVO ZN-treated beans had significantly ($P<0.05$) lower yields compared to other treatments. Beans treated with IB11923 had the highest yield, but not significantly higher than the BENLATE or the BRAVO ZN + BENLATE-treated beans.

CONCLUSION: BRAVO ZN treatments did not have a significant effect on the incidence of sclerotinia, and, therefore did not have a significant effect on bean yield. All treatments that caused a significant decrease in the incidence of sclerotinia resulted in a significant increase in bean yield.

Table 1. Efficacy of selected fungicides for control of sclerotinia and subsequent yield of dry beans[1].

Treatment	Incidence of sclerotinia (%)		Yield (kg/ha)
	August 12	August 27	
Benlate	14 cd	38 bc	2360 a
Bravo Zn	25 ab	73 a	1354 b
Bravo Zn / Benlate	16 bc	51 b	2020 a
IB11923	5 d	20 c	2563 a
Untreated Control	35 a	80 a	1339 b
P• 0.05	s[2]	s	s
Coefficient of Variation (%)	36	24	19

[1] Values are the mean of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test. (P• 0.05).

[2] s - significant

PMR REPORT # 79 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carrera
PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Blox.)

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TITLE: EFFECT OF QUADRIS AND BRAVO SPRAYS FOR CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA

MATERIALS: QUADRIS (azoxyatrobin 250 g/L FW), BRAVO 500 F (chlorothalonil 500 g/L SU)

METHODS: A field plot was established at Vegreville, Alberta on 31 May, 1997. Field pea cv. Carrera was planted 5 cm deep with a grain drill at 22 g seeds/row. A peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodulating bacteria. Each plot consisted of four, 6 m rows, with a 20 cm row spacing. Adjacent plots were separated by 0.3 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. BRAVO and QUADRIS sprays were applied using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom (18 July) and mid-bloom (1 August), using 1000 L/ha water volume. Treatments consisted of BRAVO at 1.0 and 1.5 kg a.i./ha applied at early bloom; BRAVO at 1.0 kg a.i./ha at early and mid-bloom; QUADRIS at 125 and 175 g a.i./ha applied at early bloom; QUADRIS at 125 g a.i./ha applied at early and mid-bloom, and an untreated control, for a total of 7 treatments. Plots were assessed for symptoms of *Mycosphaerella pinodes* infection on 1 and 18 August. Disease severity was visual estimated at 5 sites in each plot using a 0-3 scale, where 0 = no symptoms; 1 = 1-20% of canopy blighted, 2 = 21-50% blighted, and 3 = >50% blighted. Each layer (upper, middle and lower) of the leaf canopy was assessed separately and ratings were totalled to create a single severity value (maximum = 9) for each sampling site. At maturity (27 August), plots were combined using a plot harvester. Seeds were dried to 16% moisture at 40 °C and weighed. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: No treatment effects were observed when disease was assessed on August 1 (Table 1). All treatments, except the single early application of QUADRIS, significantly (P• 0.05) reduced the severity of mycosphaerella blight by the time of plant maturity (August 18). Treatments where BRAVO or QUADRIS were applied at both early and mid-bloom showed the greatest reduction in disease severity. No significant differences in seed yield occurred between any of the treatments.

CONCLUSIONS: Both BRAVO and QUADRIS were effective in reducing the severity of mycosphaerella blight, especially when applied at both early and mid-bloom. However, disease severity increased too late in the season to have a significant impact on seed yield, so no treatment effects were observed. This study should be repeated under conditions where the disease develops earlier in the season to compare treatment effects on yield.

Table 1. Effect of scheduled sprays of QUADRIS and BRAVO on severity of mycosphaerella blight and seed yield of field pea at Vegreville in 1997*.

Treatment	Rate (kg a.i./ha)	Foliar disease severity (0-9)**			Yield $(g/6m^2)$
		August 1	August 18		
Control	0	2.25	6.00	a	1172
BRAVO Early Bloom	1.000	2.00	3.50	b	1129
BRAVO Early Bloom	1.500	2.00	3.25	bc	943
BRAVO Early and mid-bloom	1.000	1.75	2.00	d	1052
QUADRIS Early Bloom	0.125	2.00	3.00	bcd	1048
QUADRIS Early Bloom	0.175	2.25	5.25	a	1231
QUADRIS Early and mid-bloom	0.125	1.75	2.25	cd	1159
ANOVA $P \leq 0.05$		ns	s		ns

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Severity rating scale explained in text.

PMR REPORT # 80 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Field pea (Pisum sativum L.), cvs. Carneval and Carrera
PEST: Root rot, *Pythium ultimum* Trow, *P. irregulare* Buisman

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TITLE: EVALUATION OF FUNGICIDE SEED TREATMENTS FOR THE CONTROL OF ROOT ROT DISEASES OF FIELD PEA

MATERIALS: APRON XLS (metalaxyl 360 g/L LS), APRON FL (metalaxyl 317 g/L SN)

METHODS: Experimental plots were established on 14 May and 31 May, 1997 at Brooks and Vegreville, Alberta, respectively. Field pea cvs. Carneval and Carrera were seeded in a split-plot, randomized complete block design with four replications. Pea cultivars served as main plots and fungicides as subplots. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds of Carneval and Carrera were planted 5 cm deep at a rate of 22 g and 20 g per row, respectively. Seed was treated in a Hege II small batch seed treater at the rates given in Table 1. Inoculum containing a mixture of *P. ultimum* and *P. irregulare* was incorporated at the time of seeding at the rate of 40 mL/row. Emerged seedlings were counted three weeks after seeding along 6 m of the two middle rows of each plot. Twenty plants were sampled from each plot and the roots were assessed for root rot severity (percentage root area discolored). At maturity, plants from each plot were harvested by small plot combine on18 and 27 August, 1997, at Brooks and Vegreville, respectively. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Both fungicide seed treatments improved the average number of emerged seedlings over the untreated controls, with the exception of cv. Carrera at Brooks (Table 1). No significant (P• 0.05) differences in seedling emergence, root rot severity, or seed yield were observed between the two fungicidal seed treatments for either cultivar at either location. Neither fungicidal seed treatment had an effect on root rot severity at either site. Both fungicidal seed treatments increased yield significantly in cv. Carneval at both locations and showed higher yield at the Vegreville location for cv. Carrera. Inoculation with the *P. ultimum - P. irregulare* mixture significantly reduced emergence in cv. Carrera and yield of cv. Carneval at both locations.

CONCLUSIONS: Both fungicidal seed treatments generally had a positive effect on emergence and yield, but neither significantly reduced root rot severity.

Table 1. Effect of two APRON seed treatments on number of emerged seedlings, root rot severity and seed yield of field pea cvs. Carneval and Carrera at Vegreville and Brooks, AB in 1997*.

Treatment	Rate (mL/kg seed)	Carneval			Carrera		
-		Plants /6 m	Root rot**	Seed yield (kg/6 m^2)	Plants /6 m	Root rot**	Seed yield (kg/6 m^2)
Vegreville							
APRON XLS	0.5	61 a	0.7 a	1.68 a	49 a	0.6 a	1.33 a
APRON FL	1.1	61 a	0.5 a	1.66 a	46 a	0.6 a	1.42 a
Control		48 b	0.5 a	1.47 b	36 b	0.6 a	1.15 a
Noninoculated		58 a	0.5 a	1.82 a	49 a	0.6 a	1.38 a
Inoculated		55 a	0.6 a	1.39 b	39 b	0.6 a	1.22 a
Brooks							
APRON XLS	0.5	66 a	1.6 a	1.97 a	74 a	1.3 a	2.15 a
APRON FL	1.1	68 a	1.4 a	2.06 a	76 a	1.4 a	2.19 a
Control		58 b	1.3 a	1.75 b	71 a	1.3 a	2.19 a
Noninoculated		65 a	1.5 a	2.12 a	76 a	1.3 a	2.11 a
Inoculated		62 a	1.4 a	1.72 b	71 b	1.4 a	2.24 a

* Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P• 0.05).

** Root rot severity rating scale: 0 = clean; 1 = 1-25%; 2 = 26-50%; and 3 = >51% of the root discolored.

PMR REPORT # 81 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**

CROP: Field pea (*Pisum sativum* L.)
PEST: *Mycosphaerella pinodes* (Berk. & Blox.) Vestergr. / *Phoma medicaginis* Malbr. & Roum. var. *pinodella* (Jones) Boerema

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TITLE: FUNGICIDE CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA AT MELFORT, SASKATCHEWAN, IN 1997

MATERIALS: Azoxystrobin 250SC (QUADRIS, Zeneca Agro) 125 g ai ha^{-1} applied at first flower, chlorothalonil (BRAVO 500, ISK Bioscience) applied twice: first flower (2.0 L ha^{-1}) and mid-flower (2.0 L ha^{-1}). Both fungicides were applied with a shop built single boom bicycle sprayer, fitted with TeeJet 11001VS nozzles. Walking speed of application was adjusted to deliver the product at 275 kPa in 100 L of water ha^{-1}.

METHODS: Peas were direct seeded into barley stubble on Melfort silty clay loam soil using an Edwards high clearance hoe drill with 8 inch row spacings. Plots were 2 x 6 m with a 1m space between plots. Plots were seeded on May 14 with 22 kg ha^{-1} phosphate in furrow. The experimental design was a split-plot with fungicide treatments as main plots and cultivars as sub-plots. Cultivars and seeding rates (kg ha^{-1}) were: Highlight (188), Grande (232), Princess (179), Keoma (193), Radley (188), and Carneval (224). Seed was inoculated with peat based rhizobium prior to seeding and seeding depth was at least 2.5 cm. Plots were rated on a 0 to 9 scale based on the amount of diseased tissue observed on stems and leaves of plants (Xue et al. 1996) at four random locations within each plot at podding (August 1, 1997). Data were analysed by analysis of variance procedures using the Statistical Analysis System (SAS Institute Inc., Cary, NC).

RESULTS: The application of chlorothalonil reduced severity of disease from 3.1 on the untreated check to 1.9 (Table 1). Azoxystrobin was not significantly different from the check for disease severity rating. There were no differences in yield detected as a result of fungicide treatments. Cultivars varied for reaction to mycosphaerella blight (Table 1) with Carneval and Highlight appearing to have more severe symptoms than Grande and Radley. Grande had a higher yield than any of the other cultivars while Radley was lower in yield than any other cultivar except Princess. Fungicide by cultivar interactions were not detected for disease or yield.

CONCLUSIONS: Weather conditions at Melfort in 1997 were initially conducive to mycosphaerella development, but lack of moisture during July reduced disease progress. Extremely hot, dry weather in early August caused plants to ripen prematurely. Under these conditions chlorothalonil reduced disease severity, however neither fungicide had a detectable impact on yield. Variation in reaction to mycosphaerella blight was observed among cultivars.

Xue, A., T.D. Warkentin, M.T. Greeniaus, and R.C. Zimmer. 1996. Genotypic variability in seedborne infection of field pea by *Mycosphaerella pinodes* and its relation to foliar disease severity. Can. J. Plant Pathol. 18:370-374.

Table 1. Number of observations (n), mean disease rating (0 to 9 scale) and mean yield (kg ha^{-1}) for fungicide treatments and cultivars of field peas tested at Melfort, Saskatchewan, in 1997.

	n	Disease Rating	Yield
Fungicide			
check	24	3.1	2890.1
Azoxystrobin	24	2.5	3043.5
Chlorothalonil	24	1.9	3001.7
$Lsd_{(0.05)}$		0.8	364.6
Cultivar			
Carneval	12	2.9	2848.9
Highlight	12	2.8	3282.3
Keoma	12	2.4	3231.9
Princess	12	2.4	2129.3
Grande	12	2.3	3710.9
Radley	12	2.1	2667.4
$Lsd_{(0.05)}$		0.4	397.0

PMR REPORT # 82 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carrrera
PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Blox.)

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TITLE: COMPARISON OF QUADRIS AND BRAVO SPRAYS FOR CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA

MATERIALS: QUADRIS (azoxyatrobin 250 g/L FW), BRAVO 500 F (chlorothalonil 500 g/L SU)

METHODS: A field plot was established at Vegreville, Alberta on 31 May, 1997. Field pea cv. Carrera was planted 5 cm deep in four-row plots with a grain drill at 22 g seeds/6m row. Plot rows were spaced at 20 cm. Adjacent plots were separated by 0.3 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. A peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodulating bacteria. BRAVO and QUADRIS sprays were appplied using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom (18 July) using 1000 L/ha water volume. Treatments consisted of BRAVO at 1.5 kg a.i./ha applied at early bloom, QUADRIS at 175 g a.i./ha applied at early bloom, and an untreated control. Plots were assessed for symptoms of *Mycosphaerella pinodes* infection on 1 August. Disease severity was visual estimated at 5 sites in each plot using a 0-3 scale, where 0 = no symptoms; 1 = 1-20% of canopy blighted, 2 = 21-50% blighted, and 3 = >50% blighted. Each layer (upper, middle and lower) of the leaf canopy was assessed separately and ratings were totalled to create a single severity value (maximum = 9) for each sampling site. At maturity (27 August), plots were combined using a plot harvester. Seeds were dried to 16% moisture at 40 °C and weighed. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Both treatments showed slightly, but not significantly (P• 0.05) higher yield and lower severity of mycosphaerella blight than the untreated control (Table 1).

CONCLUSIONS: Both BRAVO and QUADRIS have the potential to reduce the severity of mycosphaerella blight and increase seed yield in field pea. However, the disease severity did not increase sufficiently from time of fungicide application to produce significant treatment effects in this trial. Studies on the efficacy of BRAVO and QUADRIS should be repeated under more severe disease pressure.

Table 1. Effect of spraying of QUADRIS and BRAVO on severity of mycosphaerella blight and seed yield of field pea at Vegreville in 1997.

Treatment	Rate (kg a.i./ha)	Foliar disease severity(0-9)*	Yield (g/6m^2)
Control	0	2.25	992
BRAVO	1.500	2.00	1177
QUADRIS	0.175	2.00	1064
ANOVA $P \leq 0.05$		ns	ns

* Severity rating scale explained in the text.

PMR REPORT # 83 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 1009653

CROP: Field pea (*Pisum sativum* L.), cvs. Montana and Carneval
PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Blox.)

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TITLE: EFFECT OF SCHEDULED SPRAYS OF BRAVO ON MYCOSPHAERELLA BLIGHT OF FIELD PEA

MATERIALS: BRAVO 500 F (chlorothalonil 500 g/L SU), BRAVO ZN (chlorothalonil 500 g/L SU), BRAVO Weatherstik (chlorothalonil 720 g/L SU)

METHODS: Field plots were established at Mundare, Alberta on 17 May, 1997 and at Westlock, Alberta on 12 May, 1997. Field pea cvs. Carrera and Montana were planted 5 cm deep with a grain drill at 22 g seeds/row. A peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodulating bacteria. Each plot consisted of four, 6 m rows, with a 30 cm row spacing. Adjacent plots were separated by 0.2 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates. Applications of BRAVO were made using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom (18 July) and mid-bloom (1 August) using 1000 L/ha water volume. Treatments consisted of BRAVO 500 at 2.0 kg a.i./ha applied at early and mid-bloom; BRAVO at 3.1 kg and 2.0 kg a.i./ha at early and mid-bloom, respectively; BRAVO ZN at 2.0 kg ai/ha applied at early and mid-bloom; BRAVO WEATHER STIK applied at 175 g a.i./ha applied at early and mid-bloom and an untreated control, for a total of seven treatments. Plots were assessed for symptoms of *Mycosphaerella pinodes* infection on 18 August. Symptoms were visually estimated as the percent of foliage area infected using a 0 - 5 scale. At maturity (27 August), plots were combined using a plot harvester. Seeds were dried to 16% moisture at 40 °C and weighed. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Results are summarized in Tables 1-4. All treatments significantly (P• 0.05) reduced the severity of mycosphaerella blight on Carerra peas at the Mundare site compared to the control (Table 1). On Montana peas at the same site, disease severity was reduced on upper and middle leaves (Table 2). At Westlock, disease severity was significantly reduced on the lower leaves and stem of Carerra (Table 3) and on most parts of Montana plants (Table 4). No significant differences occurred in seed yield for any of the BRAVO treatments at either site (Tables 1-4).

CONCLUSIONS: All BRAVO treatments reduced disease severity, but did not improve yield.

Table 1. Effect of scheduled sprays of BRAVO on severity of mycosphaerella blight and seed yield of field pea cv. Carrera at Mundare in 1997.*

Treatment	Rate (kg a.i./ha)	Disease severity**				Yield (kg/ha)
		Upper	Middle	Lower	Stem	
Control	0	0.1 a	0.8 a	2.7 a	1.7 a	4166.3
Early + Mid Spray	BRAVO 500 2+2	0.0 b	0.2 b	2.3 b	1.3 b	4553.2
Early + Mid Spray	BRAVO 500 3.1+2	0.0 b	0.1 b	2.6 ab	1.3 b	4426.7
Early + Mid Spray	BRAVO ZN 2+2	0.0 b	0.2 b	2.4 ab	1.1 b	4453.1
Early + Mid Spray	WEATHER STIK 1.75+1.75	0.0 b	0.2 b	2.3 b	1.1 b	4423.0
ANOVA P<0.05		s	s	s	s	ns

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Severity rating scale: 0 = clean, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of leaf area infected.

Table 2. Effect of scheduled sprays of BRAVO on severity of mycosphaerella blight and seed yield of field pea cv. Montana at Mundare in 1997.*

Treatment	Rate (kg a.i./ha) Upper	Middle	Lower	Stem		Yield (kg/ha)
Control	0	0.03 a*	0.7 a	2.6	1.2	4692.6
Early + Mid Spray	BRAVO 500 2+2	0.0 b	0.4 ab	2.4	1.0	4919.5
Early + Mid Spray	BRAVO 500 3.1+2	0.0 b	0.4 ab	2.5	1.0	5243.2
Early + Mid Spray	BRAVO ZN 2+2	0.0 b	0.3 b	2.5	1.0	5249.9
Early + Mid Spray	WEATHER STIK 1.75+1.75	0.0 b	0.5 ab	2.5	0.9	4285.7
ANOVA P<0.05		s	s	ns	ns	ns

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Severity rating scale: 0 = clean, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of leaf area infected.

Table 3. Effect of scheduled sprays of BRAVO on severity of mycosphaerella blight and seed yield of field pea cv. Carrera at Westlock in 1997*.

Treatment	Rate (kg a.i./ha)	Disease severity**				Yield (kg/ha)
		Upper	Middle	Lower	Stem	
Control	0	0.1	0.8	3.1 a	1.5 a	2207.6
Early + Mid Spray	BRAVO 500 2+2	0.0	0.4	2.5 b	1.2 b	2754.3
Early + Mid Spray	BRAVO 500 3.1+2	0.0	0.7	2.5 b	1.2 b	2121.1
Early + Mid Spray	BRAVO ZN 2+2	0.0	0.4	2.3 b	1.0 b	2486.7
Early + Mid Spray	WEATHER STIK 1.75+1.75	0.0	0.4	2.4 b	1.1 b	2590.6
ANOVA P<0.05		ns	ns	s	s	ns

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Severity rating scale: 0 = clean, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of leaf area infected.

Table 4. Effect of scheduled sprays of BRAVO on severity of mycosphaerella blight and seed yield of field pea cv. Montana at Westlock in 1997*.

Treatment	Rate (kg a.i./ha)	Disease severity**				Yield (kg/ha)
		Upper	Middle	Lower	Stem	
Control	0	0.5 a	1.4 a	3.3 a	1.1 a	1167.0
Early + Mid Spray	BRAVO 500 2+2	0.1 b	0.6 b	2.7 b	0.9 ab	1399.3
Early + Mid Spray	BRAVO 500 3.1+2	0.0 b	0.4 b	2.4 b	0.8 b	1643.3
Early + Mid Spray	BRAVO ZN 2+2	0.1 b	0.7 b	2.6 b	0.8 b	1375.6
Early + Mid Spray	WEATHER STIK 1.75+1.75	0.1 b	0.6 b	2.4 b	0.7 b	1286.9
ANOVA $P<0.05$		s	s	s	s	ns

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Severity rating scale: 0 = clean, 1 = 1-10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of leaf area infected.

PMR REPORT # 84 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cvs. 512, Laird and Redwing
PEST: Root rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF CROWN AS A CONTROL OF FUSARIUM ROOT ROT OF LENTIL

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL)

METHODS: Experimental plots were established on 15 May and 20 May, 1997 at Brooks and Namao, Alberta, respectively. Lentil cvs. 512, Laird and Redwing were seeded in a split-plot randomized complete block design with four replications. Lentil cultivars served as main plots and CROWN fungicide applied at two rates, along with *Fusarium*-inoculated and non-inoculated controls, served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds of 512, Laird and Redwing were planted 5 cm deep at a rate of 6 , 10 and 6 g per row, respectively. Seed was treated in a Hege II small batch seed treater at the rates given in the table below. An autoclaved mixture of rye, oats and distilled water was inoculated with *Fusarium avenaceum*, incubated at room temperature for 4 weeks, and shaken periodically to ensure complete colonization of the mixture. The mixture was air-dried, crushed and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted three weeks after seeding on 2m lengths of the middle two rows of each plot . At maturity, plants from each plot, discounting a 1-m section from each end, were hand-harvested on 4 and 17 September at Brooks and Namao, respectively. Seeds were threshed and weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Both fungicide seed treatments significantly (P• 0.05) improved the average number of emerged seedlings for all cultivars over the inoculated controls at Brooks (Table 1), but at Namao, CROWN improved the emergence only at the higher rate in Laird and at the lower rate in Redwing. Seed yield was significantly higher in the noninoculated control than in the inoculated control at both sites over all cultivars. CROWN at the lower rate significantly improved seed yield in inoculated 512 lentils at Brooks but not in Laird or Redwing. At Namao, both treatments significantly improved seed yield in the 512 lentils, but not in the other two cultivars.

CONCLUSIONS: Application of CROWN at 6 mL/kg did not improve its efficacy over 3 mL/kg for either seedling emergence or seed yield, but improved seedling emergence over the inoculated control. The reduced plant stand did not translate into lower seed yield in many cases because the remaining healthy plants were able to compensate by producing more seed per plant in the thinner stands, the only exception being the 512 lentils at Namao. Lower levels of emergence in the inoculated relative to the noninoculated controls suggests that the introduced inoculum played a major role in inducing seedling damping-off.

Table 1. Effects of CROWN on germination and seed yield of three lentil cultivars at Brooks and Namao, Alberta in 1997*.

Treatment	Rate (mL/kg)	512		Laird		Redwing	
		Plants/2m	Seed yield (g/4 m^2)	Plants/2m	Seed yield (g/4 m^2)	Plants/2m	Seed yield (g/4 m^2)
Brooks							
Control		30.0 a	1320 a	29.7 a	978 a	31.1 a	943 a
CROWN + F•	3	28.2 a	1078 b	27.8 a	915 ab	27.0 a	800 ab
CROWN + F	6	26.8 a	1020 bc	25.9 a	900 ab	25.9 a	745 ab
Fusarium (F)	17.2 b	823 c	18.7 b	720 b	17.5 b	618 b	
Namao							
Control		46.8 a	1584 a	40.3 a	986 a	39.4 a	1160 a
CROWN + F	3	31.6 b	1483 a	28.9 bc	872 ab	34.8 a	1020 ab
CROWN + F	6	31.1 b	1412 a	31.3 b	727 b	29.2 b	1056 ab
Fusarium (F)		31.6 b	1224 b	22.9 c	700 b	26.3 b	976 b

* Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P• 0.05).

• Denotes inoculation with *Fusarium avenaceum*

PMR REPORT # 85 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Lettuce
PEST: Downy mildew (*Bremia lactucae* Regal.)

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TITLE: FIELD EVALUATION OF FORECASTING SYSTEMS TO OPTIMIZE FUNGICIDE APPLICATIONS FOR DOWNY MILDEW OF LETTUCE, 1997.

MATERIALS: Lettuce (cv. Ithaca) and DITHANE DG (mancozeb 75 %), RIDOMIL MZ 72 WP (metalaxyl 8%, mancozeb 64%), RIDOMIL GOLD MZ (metalaxyl-m 3.9%, mancozeb 64%) and ALIETTE (fosetyl AL 80%)

METHODS: Two on-station (MCRS) sites (sites 1 and 2) and 1 commercial field site (site 3) were established in the Holland Marsh, Ontario. All sites consisted of direct seeded plots (on organic soil, pH 6.4, organic matter 60%) of lettuce were assessed for downy mildew after thinning (rows thinned to 3 heads per m with 4 rows per bed) was complete. Seeding and therefore, thinning were staggered throughout the growing season. Assessment for incidence of downy mildew began 23 Jun (site 1), 3 Sept (site 2) and 29 Jul (site 3). Each plot consisted of 10 (site 1), 11 (site 2) or 7 (site 3) treatments with 4 replications in a randomized complete block design. Each weekday, between 8 and 10 am, 15 plants per replication were assessed for visible downy mildew symptoms and leaf wetness until harvest. Fungicide treatments, were initiated following thinning. On-station the fungicides were applied using a pull type plot sprayer with DG Tee jet 8002 VS flat fan nozzles at 100 psi. (boom) and at the commercial site using a Solo back pack sprayer (60 psi.) with a fan-jet nozzle. The Conventional treatments, treatments 2, 3, 4 and 5 (sprayed as recommended in the Ontario Ministry of Agriculture, Food and Rural Affairs Vegetable Production Recommendations, Pub. 363 1996/1997) were sprayed on a 7 to 10 (protection period) day schedule with DITHANE DG (2.25 kg in 500 L H_20/ha,) or a 14 to 21 (protection period) day schedule with RIDOMIL MZ (2.5 kg in 500 L H_20/ha), RIDOMIL GOLD MZ (2.5 kg in 500 L H_20/ha) or ALIETTE (4.5 kg in 500 L H_20/ha) respectively. Treatment 6 plots were sprayed based on the presence of disease; when the first downy mildew lesion was detected DITHANE DG was applied. Subsequent applications were a rotation between RIDOMIL MZ 72 and DITHANE DG, applied on a 14 and 7 day schedule, respectively. Treatment 7 was a RIDOMIL 2G seed in-furrow granular application (115 g/100 m of row) with no subsequent fungicide applications. Treatments 8 and 9 (Forecasting system 1, developed by Carisse) and 10 and 11 (Forecasting system 2, developed by Kushlappa) were sprayed when model criteria were met. The first criteria for both systems was the achievement of a sporulation infection period (SIP). A SIP was recorded each time the leaves were wet for 3-5 hours before dawn and remained so until 10am. Forecasting system 2 plots were then sprayed with Dithane DG (treatment

10) and Ridomil MZ 72 WP (treatment 11), subsequent sprays occurred when a SIP was recorded after the fungicide protection period had elapsed. In Forecasting system 1, from the time a SIP occurred, degree days (DD) were calculated (base 0°C). When 110 DD were accumulated, treatment 8 was sprayed with DITHANE DG and when 135 DD were accumulated, treatment 9 was sprayed using RIDOMIL MZ 72 WP. Subsequent sprays were made when a recorded SIP had reached the accumulated DD number and the plants were no longer covered by the fungicide protection period. Leaf wetness was assessed visually and leaf wetness and ambient temperature were also recorded at 1 min intervals using an electronic grid leaf wetness sensor and HMP35C temperature and relative humidity probe connected to a CR21X Campbell Scientific Data logger and stored at 15 min averages. The sensors were placed within the canopy at leaf height. No fungicides were applied to the control plots. Recommended control procedures for weeds and insects were followed. Air temperatures were below the long term (10 year) average for May, Jul and Aug, above for Jun and a similar to the long term average for Sep and Oct. Total rainfall was below the long term (10 year) average for May (62.2mm), Jun (65.8mm), Jul (25.6mm), Aug (48mm) and Oct (32mm) and above for Sept (119mm). The lack of accumulated precipitation and the lack of irrigation resulted in a drought situation. At harvest a sample of 15 heads (s1) and 25 heads (s2) from each repetition of the MCRS plots were graded for downy mildew incidence and disease severity. Disease severity was assessed using a scale from zero to five: zero - no lesions, one - 1 lesion, two - 2 to 5 lesions, three - 6 to 10 lesions, four - 11 to 15 lesions and five - > & = 16. The total head number/scale was then multiplied by a factor (zero x 0, one x 1, two x 2, three x 4, four x 8 and five x 16) and summed to give a total for disease severity. Head weight was recorded from 25 heads (s1 and s2) and 18 heads at the commercial site. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: There were no significant (P=0.05) differences between treatments at each site in total and marketable yield and harvest weights at sites 1 and 3. Site 3 did not develop visible signs of downy mildew infection. All fungicide treatments at site 1 significantly reduced the incidence of downy mildew and disease severity (Table 1) compared to the control but there were no significant (P=0.05) differences between any of the fungicide treatments. Site 2 developed downy mildew before thinning in all treatments except for the Seed in-furrow with RIDOMIL 2G but, assessment did not begin until after thinning. At site 2, the treatments: Conventional with RIDOMIL MZ and GOLD MZ, Forecasting system 1 with DITHANE DG and treatment sprayed when disease was detected with a rotation between DITHANE DG and RIDOMIL MZ , had significantly lower downy mildew incidence than the control but were not significantly different from each other. The disease index was significantly lower in the above mentioned treatments as well as the Seed in-furrow with RIDOMIL 2G than the control. The plots which had been treated with RIDOMIL 2G as a seed in-furrow application did not develop any symptoms of downy mildew until 3 weeks before harvest. Site 2 plots were harvested before head maturity; the Seed in-furrow with RIDOMIL 2G and the Conventional with RIDOMIL MZ had the highest harvest weights (Table 2) but were only significantly higher than Forecasting system 1 with RIDOMIL MZ, control and Conventional with ALIETTE. The correlation between downy mildew incidence and index was significant, positive and high (r^2=0.9, P=0.0005) for sites 1 and 2. There were no significant differences between Conventional with RIDOMIL MZ and GOLD MZ among any of the variables measured at any site. Forecasting systems 1 and 2, at sites 1 and 2 resulted in a 25% reduction in DITHANE DG application and a 33% percent reduction in RIDOMIL MZ application compared to their respective conventional treatments. Site 2 demonstrates that when conditions are favourable for downy mildew development during lettuce emergence; downy mildew fungicide applications should begin. Further study into the use of RIDOMIL 2G as a seed in-furrow application for downy mildew control is necessary.

Table 1. Downy mildew incidence % (DMI) and severity (DMS), severity measured by calculated disease index) from 25 lettuce heads at harvest and number of times each treatment sprayed (#S) before harvest at 2 MCRS sites in 1997.

Treatment	Site 1			Site 2		
	DMI (%)	DMS	#S	DMI (%)	DMS	#S
Control	46.7 a*	13.0 a	0	88.0 a	51.8 a	0
Forecasting system 2 - DITHANE DG	0 b	0 b	3	77.0 ab	43.0 a-c	3
Conventional - ALIETTE	1.7 b	0.3 b	3	74.0 ab	34.0 a-d	3
Forecasting system 1 - RIDOMIL MZ	1.7 b	0.3 b	2	73.0 ab	45.0 ab	2
Conventional - DITHANE DG	0 b	0 b	4	73.0 ab	31.8 a-e	4
Forecasting system 2 - RIDOMIL MZ	1.7 b	0.3 b	2	62.0 a-c	35.0 a-d	2
Seed In-furrow - RIDOMIL 2G		-----		----- -	53.0 a-24.8 b-e0	
Conventional - RIDOMIL GOLD MZ	1.7 b	0.3 b	3	44.0 b-d	18.8 c-e	3
Conventional - RIDOMIL MZ	0 b	0 b	3	35.0 cd	18.0 de	3
Forecasting system 1 - DITHANE DG	1.7 b	0.5 b	3	32.0 cd	12.5 de	3
Sprayed on presence of disease	0 b	0 b	2	20.0 d	8.8 e	3

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 2. Lettuce head harvest weights (kg) after of 25 heads from the 2 MCRS sites and 18 heads from the off-station site (in the Holland Marsh, Ontario) from the lettuce downy mildew trials, in 1997.

Treatment	Harvest weights (kg)		
	Site 1	Site 2	Site 3
Forecasting system 2 - DITHANE DG	29.6 a*	3.5 ab	16.1 a
Control	27.6 a	2.6 b	-----
Forecasting system 1 - RIDOMIL MZ	29.4 a	2.8 bc	15.2 a
Conventional - DITHANE DG	31.8 a	3.4 a-c	15.4 a
Seed In-furrow RIDOMIL 2G	-----	3.9 a	-----
Conventional - ALIETTE	27.1 a	2.6 b	-----
Forecasting system 2 - RIDOMIL MZ	29.3 a	3.2 a-c	16.0 a
Conventional - RIDOMIL GOLD MZ	29.8 a	3.2 a-c	-----
Conventional - RIDOMIL MZ	29.3 a	3.9 a	15.1 a
Forecasting system 1 - DITHANE DG	31.3 a	3.4 a-c	15.9 a
Sprayed on presence of disease	29.6 a	3.2 a-c	16.1 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 86 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Lettuce
PEST: Pythium stunt *(Pythium spp.)*

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TITLE: FIELD EVALUATION OF FURROW APPLICATIONS OF RIDOMIL FOR THE CONTROL OF PYTHIUM STUNT OF LETTUCE, 1997.

MATERIALS: Lettuce (cv. Ithaca) and RIDOMIL 2G (metalaxyl 2%), RIDOMIL GOLD 2.5G (mefanoxam 2.5%) and RIDOMIL GOLD 1G (mefanoxam 1%).

METHODS: Lettuce was direct seeded, using a Stan Hay precision seeder, into organic soil (pH 6.4, organic matter 60%) on two seeding dates, 14 and 28 May 1997 in a commercial field site, with a history of pythium stunt, in the Holland Marsh, Ontario. In-furrow treatments consisted of a control, RIDOMIL 2G at 115 g/100 m of row, RIDOMIL GOLD 2.5G at 46 g/100 m of row and RIDOMIL GOLD 1G at 115 g/100 m of row. All lettuce plants were assessed for pythium stunt after thinning (rows thinned to 3 heads per m with 4 rows per bed) was complete and continued once per week until harvest. Plants with pythium stunt were counted, recorded as incidence (%) of pythium stunt and rogued out of the plots. Assessment began 11 Jun for the first seeding date and 25 Jun for the second seeding date. Treatments were arranged in a randomized complete block design with four replications per treatment. Air temperatures were below the long term (10 year) average for May, Jul and Aug, above for Jun and similar to the long term average for Sep and Oct. Total rainfall was below the long term (10 year) average for May (62.2mm), Jun (65.8mm), Jul (25.6mm), Aug (48mm) and Oct (32mm) and above for Sept (119mm). Irrigation was used to offset the lack of precipitation during seed germination and seedling emergence only. Recommended control procedures for fungal pathogens, weed and insects were followed. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: Incidence of pythium stunt was low in both plots. These low levels could have been due to the very dry conditions during the growing period of the plot. As well, in the spring the grower had dug out the ditch and spread the soil over the outer perimeter of the field, all the trials were in the outer perimeter. There may have been lower levels of *Pythium* spp. in the soil recovered from the ditches. In the plot seeded 14 May, RIDOMIL 2G reduced pythium stunt compared to the untreated control. Levels of pythium stunt in lettuce treated with RIDOMIL 2G and RIDOMIL GOLD 2.5G were not significantly

(P=0.05) different. Levels of pythium stunt were very low in lettuce seeded 28 May and there were no significant differences among treatments.

Table 1. Cumulative lettuce pythium stunt incidence at two seeding dates, in a commercial lettuce field in the Holland Marsh, Ontario, 1997.

Treatment	Cumulative pythium stunt incidence (%)	
----	14 May	28 May
RIDOMIL 2G	1.22 a*	0.11 a
RIDOMIL GOLD 2.5G	1.72 ab	0.14 a
RIDOMIL GOLD 1G	-----	0.11 a
CONTROL	4.87 b	0.57 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 87 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.)

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TITLE: EVALUATION OF DIALLYL DISULPHIDE (DADS) AND DIPROPYL DISULPHIDE (DPDS) FOR CONTROL OF ONION BULB INFECTION BY THE WHITE ROT PATHOGEN, *SCLEROTIUM CEPIVORUM* BERK, AT HARVEST, 1997.

MATERIALS: Two germination stimulants (artificial garlic oil): DADS (diallyl disulphide 85.5%, diallyl sulphide 4.5%) and DPDS (n-propyl disulphide 88%, related compounds, 2%).

METHODS: Onions were assessed for incidence of white rot on 5 and 12 Sept, 1997 in two commercial onion fields (organic muck soil, pH 6.4, organic matter 60%) which had been established in Jul 1995, in the Holland Marsh, Ontario. These sites had known histories of white rot and had been treated with DADS and DPDS twice including an untreated check. The treatments were replicated 6 times and arranged in a randomized complete block design. Applications were made when the grower finished harvesting the crop which was present at the site and the maximum soil temperature at 10cm remained below 21 C for several days in order to avoid the possibility of soil temperatures exceeding 24 C at any time in the fall after treatment. The two products, DADS and DPDS, each applied on both 21 Aug, 1995 and 19 Sept, 1996, were applied to depths of 10 and 20cm using a modified Vorlex soil fumigation apparatus with eleven injection hoses spaced 20cm apart at a rate of 10L of product/ha in 500L of water/ha. The plot areas were sealed, following treatment, using a mechanical roller and the soil remained undisturbed until spring. In the spring of 1997, the grower seeded the sites and managed the onions for the full season. Air temperatures were below the long term (10 year) average for May, Jul and Aug, above for Jun and not different from the long term average for Sept and Oct. Total rainfall was below the long term (10 year) average for May (62.2mm), Jun (65.8mm), Jul (25.6mm), Aug (48mm) and Oct (32mm) and above for Sept (119mm). The lack of accumulated precipitation and the lack of irrigation resulted in a drought stress situation. Onions were assessed from 4 subplots in each of the 6 replications at harvest maturity, for incidence of white rot. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix v. 4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Incidence of white rot was relatively low at all sites due to the hot dry summer conditions in 1997 which was unfavourable for white rot development. However, onions grown in DADS treated soil at both sites had significantly (P=0.05) lower levels of white rot than the untreated checks. The synthetic garlic oil, DADS, resulted in the lowest white rot incidence overall, reducing incidence by 99% at site 1 and totally at site 2. The DPDS treatments resulted in significantly lower incidence of white rot than the check at site 2.

Table 1. Evaluations of DADS and DPDS for the control of white rot in muck soils, in the Holland Marsh, Ontario, at two commercial field sites, in 1997.

Treatment	White rot incidence (%)	
	SITE 1	SITE 2
DADS	0.07 a*	0 a
DPDS	7.05 b	1.51 a
CHECK	13.02 b	5.19 b

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR # 88 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.)

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TITLE: FIELD EVALUATION OF COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *SCLEROTIUM CEPIVORUM* BERK, 1997.

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Dr. R. Maxwell at Petoseed, Asgrow Ltd., and 6 commercial cultivars: Fortress, Hamlet, Joint Venture, Norstar, Paragon and Prince.

METHODS: Field resistance to white rot was investigated at 4 commercial sites (organic soil, pH 6.4, organic matter 60%) with histories of white rot in the Holland Marsh, Ontario, in 1997. Onion lines from three sources (University of Wisconsin, Petoseed and Asgrow and 6 commercial cultivars), were seeded in 288 plug trays in the greenhouse on 14 and 15 Apr and hand-transplanted in the field on 9 Jun (site 1), 10 and 11 Jun (site 2), 12 and 13 Jun (sites 3 and 4). Plant spacing was 23 plants/m in 2 rows 1.75 m in length and 4 cm apart with 42 cm space between each double rows. Each line was replicated four times in a randomized complete block design. Recommended control procedures for weed and insects were followed. Air temperatures were below the long term (10 year) average fro Jul and Aug, above for Jun and not different from the long term average for Sept and Oct. Total rainfall was below the long term (10 year) average for Jun (65.8mm), Jul (25.6mm), Aug (48mm) and Oct (32mm) and above for Sept (199mm). The lack of accumulated precipitation and the lack of irrigation resulted in a drought stress situation for sites 1, 2 and 3. Irrigation was used to offset the lack of precipitation at site 4. Onion bulbs were assessed for visible white rot incidence at harvest maturity, in the field on 22 Sept (site 1), 1 Oct (site 2), 30 Sept (site 3) and 10 Oct (site 4). Data were analysed using the General Analysis of Variance function and General Contrast function of the Linear Models section of Statistix, V. 4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Incidence of white rot was low at all sites in 1997 due to hot dry growing conditions. Site 1 did not develop any signs of infection by *Sclerotium cepivorum* at harvest. White rot incidence was not significant ($P=0.05$) within cultivars and breeding lines at sites 3 and 4. Significant differences among cultivars and breeding lines were found at site 2. The cultivar Fortress did not develop symptoms of white rot infection and had significantly less white rot than Hamlet, Joint Venture, W101-96, Prince, W102-96 and PS650396. When the breeding lines were grouped, the contrast between the University of Wisconsin and Petoseed breeding lines was not significant (P=0.220). The breeding material for the resistant lines for both the University of Wisconsin and Petoseed came from original work and material from concurrent work done between Dr. J. Rahe at Simon Fraser University in British Columbia (Rahe, 1986) and Dr. W.H. Gabelman at the University of Wisconsin (Gabelman, 1986). Therefore, the genetic material is similar and the contrast between the two groups was not significant.

Table 1. Harvest incidence of white rot in onion lines grown at three sites in the Holland Marsh, Ontario, in 1997.

Onion line	White rot field harvest incidence (%)		
	Site 2	Site 3	Site 4
HAMLET	3.76 a****	2.57 a	0 a
JOINT VENTURE	3.60 ab	0.32 a	0.33 a
W101-96*	3.59 ab	1.04 a	0 a
PRINCE	2.92 a-c	1.89 a	0.31 a
W102-96	2.58 a-d	-----	0 a
PS650396**	2.54 a-d	0.68 a	0.68 a
PS650196	2.42 a-e	-----	0.28 a
W912-97	2.29 a-e	-----	0 a
PS650096	2.24 a-e	-----	0.31 a
PSW457	2.05 a-e	-----	0 a
W916-97	1.92 a-e	-----	0 a
XPH15055***	1.41 a-e	1.09 a	0 a
PARAGON	1.29 a-e	0.99 a	0.61 a
W104-96	1.27 b-e	-----	1.07 a
W918-97	0.97 c-e	-----	0 a
W914-97	0.68 c-e	0.32 a	0 a
W920-97	0.66 c-e	1.25 E-17 a	0.64 a
PSWR456	0.66 c-e	0 a	1.30 a
W105-96	0.63 c-e	-----	0.30 a
W924-97	0.37 de	0 a	1.49 a
PS650296	0.32 de	0.30 a	0.37 a
NORSTAR	0.31 de	0.32 a	0.33 a
W910-97	0.30 de	-----	0 a
FORTRESS	0 e	5.78 E-18 a	0 a

* Lines beginning with the designation "W" were breeding lines from the University of Wisconsin

** Lines beginning with the designation "P" were breeding lines from Petoseed.

*** The line beginning with the designation "XPH" was a breeding line from Asgrow Ltd.

**** Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

REFERENCES:

Rahe, J.E., 1986. Detection and selection for field resistance to onion white rot. In Third International Workshop on *Allium* White Rot. pp. 11-17.

Gabelman, W.H., 1986. White rot resistance from *Allium cepa* cv. Zittauer Gelb. In Third International Workshop on *Allium* White Rot. pp. 9-10.

PMR # 89 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.)

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TITLE: EVALUATION OF COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO WHITE ROT USING A SCALE INOCULATION TECHNIQUE, 1997.

MATERIALS: Onion bulbs harvested from the 1996 White Rot resistant field trials grown in the Holland Marsh. Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Petoseed, and 4 commercial cultivars: Fortress, Joint Venture, Norstar and Paragon. Two isolates of *Sclerotium cepivorum* Berk, MCG-1, 1-9 and MCG-2, 3-6.

METHODS: Scale segments of harvested yellow cooking onion bulbs of 4 commercial cultivars and 20 breeding lines, grown in the Holland Marsh, Ontario, in a commercial field in 1996, were inoculated with mycelial plugs of two isolates of *Sclerotium cepivorum* on 17 Feb, 1997. Onion scale segments were prepared for inoculation as follows: bulbs were surface disinfested, after removal of the outer scales, in a 10% commercial Javex bleach solution (5 minutes), rinsed and air dried. Segments (5 cm x 5 cm) were cut, the inner membrane was removed and the scales were inoculated. Two *S. cepivorum* isolates were used for inoculation representing two distinct mycelial compatibility groups (MCG-1, 1-9 and MCG-2, 3-6) present in the Holland Marsh. Agar discs, 5 mm in diameter, were cut from the margins of actively growing cultures using a sterile cork borer and placed mycelium side down in the centre of each segment (concave side). Each mycelial line was replicated four times in a randomized complete block design in sterilized plastic trays and stacked in a plexiglass chamber, filled with water to 7.5 cm. A hygrothermograph was placed inside and the chamber was covered with a black sheet. After incubation of 7 days, at room temperature, the lesion diameter on each scale (convex side) was measured. All data were analysed using the General Analysis of Variance function and the Pearson Correlation function of the Linear Models section of Statistix V. 4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant (P=0.05) differences in lesion diameters (13.9 to 29.4 mm) among onion lines harvested in 1996 and inoculated in 1997 were found. There was not a significant (P=0.228) isolate by line interaction, therefore, the results from the two isolates were pooled. The cultivars and onion breeding lines could be divided into two groups with smaller lesion diameters (University of Wisconsin) and larger lesion diameters (Petoseed). There was a significant and positive correlation (r^2=0.40, P=0.0005) between the lesion diameters on onion scales inoculated with the two isolates, MCG-1 and MCG-2, of *Sclerotium cepivorum*. The onion lines which gave the largest lesion diameters when inoculated with MCG-1, also gave the largest lesion diameters when inoculated with MCG-2. The resulting correlation was not high, indicating that there are more factors than onion cultivar and MCG involved in determining the resulting lesion diameter.

Table 1. Lesion diameters on onion scales inoculated with *Sclerotium cepivorum* mycelia, 1997.

Onion line	Diameter of lesion (mm)		
	MCG pooled	MCG-1, 1-9	MCG-2, 3-6
PSR459194*	25.38 a***	28.75 a	22.00 ab
PSR459294	24.81 ab	29.38 a	20.25 a-f
PSR459694	23.50 a-c	27.50 ab	19.50 a-g
WR458	23.25 a-d	24.63 a-e	21.88 a-c
FORTRESS	23.06 a-d	27.50 ab	18.63 a-h
JOINT VENTURE	23.06 a-d	24.38 a-e	21.75 a-d
PSR459094	22.31 a-e	25.00 a-d	19.63 a-g
W455B**	22.19 a-f	26.25 a-c	18.13 a-h
XW455B	22.06 a-f	24.88 a-e	19.25 a-g
W454B	21,63 a-g	20.38 c-f	22.88 a
PSR459394	20.81 b-h	23.38 a-e	18.25 a-h
XW459C	20.75 b-h	23.38 a-e	18.13 a-h
XW458C	20.44 c-h	23.75 a-e	17.13 c-h
PSR459494	20.25 c-h	22.63 b-f	17.88 b-h
PSR459594	20.13 c-h	24.25 a-e	16.00 f-h
NORSTAR	20.06 c-h	18.88 ef	21.25 a-e
WR459	19.69 c-h	22.13 b-f	17.25 b-h
W459C	19.13 d-h	21.50 b-f	16.75 e-h
W458C	19.13 d-h	21.25 c-f	17.00 d-h
W456C	18.81 e-h	20.00 d-f	17.63 b-h
XW456C	18.50 e-h	22.00 b-f	15.00 gh
W457C	18.00 f-h	19.13 d-f	16.88 eh
PSR458994	17.50 gh	21.13 c-f	13.88 h
PARAGON	16.75 h	17.25 f	16.25 f-h

* Lines beginning with the designation "PSR" and "WR" were breeding lines from Petoseed.

** Lines beginning with the designation "W" and "XW" were breeding lines from the University of Wisconsin.

*** Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 90 **SECTION I:** **DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.)

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TITLE: EVALUATION OF COMMERCIAL YELLOW COOKING ONION CULTIVARS FOR RESISTANCE TO WHITE ROT USING A SCALE INOCULATION TECHNIQUE, 1997.

MATERIALS: Onion bulbs harvested from the 1996 Muck Research Station Main Cultivar Trial. Two isolates of *Sclerotium cepivorum* Berk, MCG-1, 1-9 and MCG-2, 3-6.

METHODS: Scale segments of harvested yellow cooking onion bulbs of 41 commercial cultivars, grown in the Holland Marsh, Ontario, at the Muck Crops Research Station in 1996, were inoculated with mycelial plugs of two isolates of *Sclerotium cepivorum* on 17 Feb, 1997. Onion scale segments were prepared for inoculation as follows: bulbs were surface disinfested, after removal of the outer scales, in a 10% commercial Javex bleach solution (5 minutes), rinsed and air dried. Segments (5cm x 5cm) were cut, the inner membrane was removed and the scales were inoculated. Two *S. cepivorum* isolates were used for inoculation representing two distinct mycelial compatibility groups (MCG-1, 1-9 and MCG-2, 3-6) present in the Holland Marsh. Agar discs, 5 mm in diameter, were cut from the margins of actively growing cultures using a sterile cork borer and placed mycelium side down in the centre of each segment (concave side). Each mycelial line was replicated four times in a randomized complete block design in sterilized plastic trays and stacked in a plexiglass chamber, filled with water to 7.5cm. A hygro-thermograph was placed inside and the chamber was covered with a black sheet. After incubation of 7 days, at room temperature, the lesion diameter on each scale (convex side) was measured. All data were analysed using the General Analysis of Variance function and the Pearson Correlation function of the Linear Models section of Statistix V. 4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant (P=0.05) differences in lesion diameters (22.8 to 39.7 mm) among onion cultivars harvested in 1996 and inoculated in 1997 were found. There was not a significant (P=0.052) isolate by line interaction, therefore, the results from the two isolates were pooled. There was a significant and positive correlation (r^2=0.20, P=0.01) between the lesion diameters on onion scales inoculated with the two isolates, MCG-1 and MCG-2, of *Sclerotium cepivorum*. The onion cultivars which gave the largest lesion diameters when inoculated with MCG-1 also gave the largest lesion diameters when inoculated with MCG-2. The resulting correlation was not high, indication that there are more factors than onion cultivar and MCG involved in determining the resulting lesion diameters.

Table 1. Lesion diameter on onion scales inoculated with *Sclerotium cepivorum* mycelia, 1997.

Cultivar	Source	Diameter of lesion (mm)		
		MCG pooled	MCG-1, 1-9	MCG-2, 3-6
RCS6077	Rio	39.7 a*	41.8 a	37.6 a
CHALLENGE	Rio	37.4 ab	41.3 ab	33.6 a-c
RCS1090	Rio	35.9 ab	37.0 a-c	34.9 ab
T383	Stokes	34.6 b-c	36.0 a-e	33.3 b-d
FRONTIER	American Takii	33.3 b-d	34.8 a-f	31.9 b-f
IMPACT	Harris Moran	33.3 b-d	36.8 a-d	29.9 c-h
QUANTUM	Petoseed	30.9 c-e	31.8 c-i	30.1 c-g
T383	American Takii	30.8 c-f	31.9 c-i	29.6 c-h
SUNTRE1461	Sun Seeds	30.4 c-f	31.9 c-i	29.0 d-i
HUSTLER	Harris Moran	29.9 d-g	33.9 b-g	26.0 g-m
TRAPPS#6	Erie James	29.9 d-g	32.3 c-h	27.6 f-k
TRAPPS#7	Crookham	29.9 d-g	30.4 c-j	29.4 c-h
NORSTAR	Stokes	29.6 d-h	29.9 c-j	29.3 c-h
CORONA	Bejo	29.4 d-h	29.5 d-j	29.4 c-h
PS351692	Petoseed	28.9 e-h	25.8 h-k	27.0 b-e
CAVALIER	Asgrow	28.9 e-h	29.5 d-j	28.3 e-j
HAMLET	Asgrow	28.3 e-i	29.4 d-j	27.3 g-l
PS44189	Petoseed	28.0 e-i	30.1 c-j	25.9 g-m
T58756	Bejo	27.2 e-i	28.0 f-k	26.4 g-m
VOYAGER	Harris Moran	27.2 e-i	30.0 c-j	24.4 j-m
BENCHMARK	Asgrow	27.1 e-i	28.3 f-k	26.0 g-m
TRAPPS#9	Erie James	27.1 e-i	30.6 c-i	23.6 k-m
TRAPPS#7	Erie James	26.9 e-j	26.5 g-k	27.3 g-l
LEGACY	Sun Seeds	26.8 e-j	29.0 e-k	24.6 j-m
FMX2045	Ferry-Morse	26.8 e-j	28.8 e-k	24.8 i-m
TOPNOTCH	Crookham	26.8 e-j	28.9 e-k	24.6 j-m
LEXINGTON	J.C. Canners	26.7 e-j	26.3 h-k	27.3 g-l
FRONTIER	Stokes	26.7 e-j	28.8 e-k	24.6 j-m
GAZETTE	Petoseed	26.6 e-j	26.0 h-k	27.3 g-l
PS351392	Petoseed	26.6 e-j	26.3 h-k	32.0 g-l
TAMARA	Bejo	26.5 f-k	26.8 g-k	26.3 g-m
PARAGON	Sun Seeds	25.9 g-k	24.9 h-k	28.0 g-l
HEADLINER	Petoseed	25.8 g-k	28.0 f-k	23.5 k-m
ATHOS	Vilmoran	25.7 g-k	28.1 f-k	23.3 l m
ADVANCER	Harris Moran	25.5 h-k	26.5 g-k	24.6 j-m
PROMISE	Crookham	25.3 h-k	26.8 g-k	23.9 k-m
XPH15004	Asgrow	25.1 i-k	24.5 i-k	25.6 h-m
TORQUE	Crookham	25.0 i-k	25.8 h-k	24.3 j-m
TURBO	Crookham	24.9 i-k	25.9 h-k	23.9 km
FORTRESS	Asgrow	24.0 jk	21.6 k	26.4 g-m
PRINCE	Stokes	22.8 k	23.0 jk	22.5 m

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's

Protected LSD Test.

PMR REPORT # 91 **SECTION I: DISEASSES OF VEGETABLES AND SPECIAL CROPS**

ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.)

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TITLE: EVALUATION OF COMMERCIAL RED ONION CULTIVARS FOR RESISTANCE TO WHITE ROT USING A SCALE INOCULATION TECHNIQUE, 1997.

MATERIALS: Onion bulbs harvested from the 1996 Muck Research Station Main Red Cultivar Trial. Two isolates of *Sclerotium cepivorum* Berk, MCG-1, 1-9 and MCG-2, 3-6.

METHODS: Scale segments of harvested red onion bulbs of 11 commercial red onion cultivars, grown in the Holland Marsh, Ontario, at the Muck Crops Research Station in 1996, were inoculated with mycelial plugs of two isolates of *Sclerotium cepivorum* on 17 Feb, 1997. Onion scale segments were prepared for inoculation as follows: bulbs were surface disinfested, after removal of the outer scales, in a 10% commercial Javex bleach solution (5 minutes), rinsed and air dried. Segments (5cm x 5cm) were cut, the inner membrane was removed and the scales were inoculated. Two *S. cepivorum* isolates were used for inoculation representing two distinct mycelial compatibility groups (MCG-1, 1-9 and MCG-2, 3-6) present in the Holland Marsh. Agar discs, 5mm in diameter, were cut from the margins of actively growing cultures using a sterile cork borer and placed mycelium side down in the centre of each segment (concave side). Each mycelial line was replicated four times in a randomized complete block design in sterilized plastic trays and stacked in a plexiglass chamber, filled with water to 7.5cm. A hygro-thermograph was placed inside and the chamber was covered with a black sheet. After incubation of 7 days, at room temperature, the lesion diameter on each scale (convex side) was measured. All data were analysed using the General Analysis of Variance function and the Pearson Correlation function of the Linear Models section of Statistix V. 4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant (P=0.05) differences in lesion diameters (19.0 to 34.1 mm) among red onion cultivars harvested in 1996 and inoculated in 1997 were found. There was not a significant (P=0.345) isolate by line interaction, therefore, the results from the two isolates were pooled. There was a significant and positive correlation (r^2=0.20, P=0.01) between the lesion diameters on onion scales inoculated with two isolates, MCG-1 and MCG-2, of *Sclerotium cepivorum*. The onion lines which gave the largest lesion diameters when inoculated with MCG-1 also gave the largest lesion diameters when inoculated with MCG-2. The resulting correlation was not high, indicating that there are more factors than onion cultivar and MCG involved in determining the resulting lesion diameter. On average, Redwing and Tango had smaller lesions than XPH95H72, Fuego, Mars and Mercury.

Table 1. Lesion diameters on onion scales inoculated with *Sclerotium cepivorum* mycelia,1997.

Cultivar	Source	Diameter of lesion (mm)		
		MCG pooled	MCG-1, 1-9	MCG-2, 3-6
XPH95H72	Crookham	30.8 a*	32.6 ab	29.0 ab
FUEGO	Petoseed	30.6 a	32.6 ab	29.0 ab
MARS	Petoseed	29.9 ab	34.1 a-c	25.6 a-c
MERCURY	Petoseed	29.9 ab	29.3 a-d	30.5 a
MAMBO	Sun Seeds	29.7 ab	30.1 a-d	29.3 a
LUCIFER	Stokes	25.9 a-c	24.8 de	27.1 ab
SANGRIA	Stokes	25.9 a-c	26.0 b-e	25.9 ab
REDMAN	Ferry-Morse	24.8 bc	24.4 de	25.3 a-c
BENNYSRED	Harris Moran	24.8 bc	25.3 c-e	24.4 a-c
TANGO	Sun Seeds	22.3 c	25.1 c-e	19.4 c
REDWING	Bejo	20.8 c	19.0 e	22.6 bc

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 92 **SECTION I: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.)

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TITLE: CORRELATION BETWEEN THE FIELD EVALUATION OF ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO WHITE ROT AND A SCALE INOCULATION TECHNIQUE, 1997.

MATERIALS: Onion bulbs harvested from the 1996 White Rot resistance field trials grown in the Holland Marsh. Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, and Petoseed. Two isolates of *Sclerotium cepivorum* Berk, MCG-1, 1-9 and MCG-2, 3-6.

METHODS: See 1996 ICAR (# 206003) report "**FIELD EVALUATION OF COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *SCLEROTIUM CEPIVORUM* BERK, 1997.**" AND 1997 ICAR (# 206003) "**EVALUATION OF COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO WHITE ROT USING A SCALE INOCULATION TECHNIQUE, 1997.**" Data were analysed using the Spearman Rank Correlation function of the Association Tests section of Statistix V. 4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Spearman rank correlations were performed on averages of white rot incidence at harvest from field plots and lesion diameters on inoculated onion scales. There was a significant and positive correlation between white rot field incidence and the scale inoculation lesion diameters from MCG-1 (r^2=0.45, P=0.05) and MCG-2 (r^2=0.53, P=0.05). Overall, the breeding lines with the highest incidence of white rot in the field also had the largest lesion diameters after scales were inoculated with *S. cepivorum* and allowed to incubate.

Table 1. Field incidence of white rot in resistant onion lines grown at site 1 in the Holland Marsh, Ontario, in 1996 and subsequent lesion diameters from the plexiglass trial 1997.

Onion line	White rot field	Diameter of lesion (mm)	
	Incidence (%)	MCG-1, 1-9	MCG-2, 3-6
PSR459494*	41.19 a***	22.63 b-f	17.88 b-h
PSR459694	36.25 ab	27.50 ab	19.50 a-g
PSR459294	33.64 a-c	29.38 a	20.25 a-f
PSR459394	22.65 c-f	23.38 a-e	18.25 a-h
PSR459194	19.12 d-h	28.75 a	22.00 ab
PSR459094	17.45 d-i	25.00 a-d	19.63 a-g
W454B**	14.97 e-j	20.38 c-f	22.88 a
WR458	13.03 f-k	24.63 a-e	21.88 a-c
PSR459594	12.92 f-k	24.25 a-e	16.00 f-h
PSR458994	11.65 f-k	21.13 c-f	13.88 h
XW458C	9.81 g-k	23.75 a-e	17.13 c-h
W459C	8.69 g-k	21.50 b-f	16.75 e-h
XW455B	7.48 h-k	24.88 a-e	19.25 a-g
W456C	5.82 i-k	20.00 d-f	17.63 b-h
W458C	4.85 i-k	21.25 c-f	17.00 d-h
WR459	2.97 jk	22.13 b-f	17.25 b-h
XW459C	2.82 jk	23.38 a-e	18.13 a-h
XW456C	1.76 k	22.00 b-f	15.00 gh
W455B	1.09 k	26.25 a-c	18.13 a-h
W457C	0.78 k	19.13 d-f	16.88 eh

* Lines beginning with the designation "PSR" and "WR" were breeding lines from Petoseed.

** Lines beginning with the designation "W" and "XW" were breeding lines from the University of Wisconsin.

*** Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 93 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot (*Sclerotium cepivorum* Berk.) and Onion Maggot Fly (*Delia antiqua* Meigen.)

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TITLE: CORRELATION BETWEEN THE RESISTANCE OF COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES TO THE WHITE ROT PATHOGEN, *SCLEROTIUM CEPIVORUM* BERK. AND THE ONION MAGGOT FLY, *DELIA ANTIQUA* (MEIGEN.), 1997.

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Dr. R. Maxwell at Petoseed, and 6 commercial cultivars: Fortress, Hamlet, Joint Venture, Norstar, Paragon and Prince.

METHODS: See 1997 ICAR (# 206003) reports "**FIELD EVALUATION OF COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *SCLEROTIUM CEPIVORUM* BERK.**", "**EVALUATION OF TRANSPLANTED ONION LINES FOR MAGGOT FLY RESISTANCE**" and "**EVALUATION OF SEEDED ONION LINES FOR MAGGOT FLY RESISTANCE.**"

RESULTS: As presented in Table 1.

CONCLUSIONS: Incidence of white rot was low at all sites in 1997 due to hot dry growing conditions. Work by Esler and Coley-Smith (1983) suggested that the mechanism which initiates the germination of white rot sclerotia is linked to onion thiols and phenols and that those same chemicals attract onion maggot flies to the plant. Gabelman (1991) also suggested that there may be a positive relationship between white rot incidence and maggot fly damage in onions. A significant and positive but low correlation (Pearson, $r=0.26$, $P=0.02$) was found between white rot incidence and the first generation maggot damage from the seeded trial in 1997 (Table 1). No significant correlations were found using the Spearman Rank Correlation (Table 2). The results from the Pearson correlation suggest that a tenuous relationship exists between white rot and maggot fly resistance in onions. This relationship requires further investigation.

Table 1. Pearson Correlation between the resistance of onions to the white rot pathogen and onion maggot fly using white rot incidence (%), WRI) harvest data and maggot fly damage data (%) from the transplanted (T) and seeded (S) maggot fly trials using 1st generation (G1), 2nd generation (G2) and total damage (TD) assessments.

	WRI	TG1	TG2	TTD	SG1	SG2
TG1	-0.05					
P-value	0.69					
TG2	-0.09	0.58				
P-value	0.42	0.00				
TTD	-0.03	0.92	0.70			
P-value	0.80	0.00	0.00			
SG1	0.26	-0.10	-0.04	-0.08		
P-value	0.02	0.38	0.69	0.52		
SG2	-0.12	0.01	-0.13	-0.04	0.21	
P-value	0.28	0.91	0.25	0.75	0.07	
STD	-0.03	-0.02	-0.03	-0.05	0.66	0.53
P-value	0.77	0.87	0.82	0.64	0.00	0.00

Table 2. Spearman Rank Correlation between the resistance of onions to the white rot pathogen and onion maggot fly using white rot incidence (WRI) harvest data and maggot fly damage data (%) from the transplanted (T) and seeded (S) maggot fly trials using 1st generation (G1), 2nd generation (G2) and total damage (TD) assessments.

	WRI	TG1	TG2	TTD	SG1	SG2
TG1	-0.05					
TG2	-0.09	0.58				
TTD	-0.03	0.92	0.70			
SG1	0.26	-0.10	-0.04	-0.08		
SG2	-0.12	0.01	-0.13	-0.04	0.21	
STD	-0.03	-0.02	-0.03	-0.05	0.66	0.53

* Reject H_o if $r_s>0.450$ (n=20) for all correlations between white rot data and seeded maggot damage data and reject H_o if $r_s>0.462$ (n=19) for all correlations with transplanted maggot data (Mendenhall and Beaver, 1990. pp. 688).

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Gabelman, W.H. 1991. White rot and onion maggot. Proceedings of the National Onion Research Conference., Savannah, GA:147-151.

Mendenhall, W. and R.J. Beaver 1990. Introduction to Probability and Statistics, Eighth ed. pp. 619-622.

PMR REPORT # 94 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**

ICAR #: 206003

CROP: Yellow cooking onions, cv Fortress and Taurus
PEST: Onion Smut (*Urocystis cepulae* Frost)

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TITLE: EVALUATION OF FURROW FUNGICIDE TREATMENTS AND DRENCHES FOR CONTROL OF ONION SMUT, 1997

MATERIALS: DITHANE DG (mancozeb 75%), DITHANE M-22 (maneb 80%) methyl cellulose and PRO GRO (carbathiin 30%, thiram 50%)

METHODS: Raw onion seed (46 seeds/m) of onion cultivars Fortress and Taurus were seeded into organic soil naturally infested with onion smut (pH 6.4, organic matter 60%) at the Muck Crops Research Station on 13 and 14 May, 1997. The standard treatment for onion smut used was PRO GRO at 25 kg/ha plus 1% methyl cellulose per kg of seed. DITHANE DG at 4.4 kg/ha and 8.8 kg/ha was used with and without PRO GRO treatment and was also applied at 5.6 kg/ha without PRO GRO treatment. A DITHANE M-22 drench applied at 5.67 kg/ha in 1000 L of water with and without the standard PRO GRO treatment was also applied . An untreated check was also included. A randomized complete block arrangement with 4 blocks per replicate was used. Each replicate consisted of 2 rows (42 cm apart) of Fortress and Taurus, 5 m in length. All treatments were seeded using a push V-belt seeder. The DITHANE M-22 drench was applied at seeding with a SOLO backpack sprayer at 30 psi without a nozzle. All DITHANE DG treatments were applied at seeding by placing the DITHANE DG on the V-belt along with the seed. Three random 1 m sections were marked off, and germination counts were recorded (2, 5, 9, 12 Jun) to determine initial stand. At one (16 Jun) and three (14 Jul) true leaves one of the 1 m sections 1 m section was harvested and evaluated by looking at the bulb and leaves for evidence of smut. The remaining 1 m section was evaluated at harvest on 15 Sep. The harvest yield was taken on 4 Oct of the remaining 7 m of row. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As outlined in Tables 1, 2 and 3.

CONCLUSIONS: Significant differences (P=0.05) in levels of disease and yields were found among treatments. All fungicide treatments reduced smut compared to the untreated control on cv Taurus (Table 2). The fungicide treatments also reduced smut on cv Fortress except for Dithane DG at 4.4 and 5.6 kg/ha at the 16 Jun rating and PRO GRO plus methyl cellulose and DITHANE M-22 AT THE 15 Sep rating (Table 1). DITHANE DG at 8.8 kg/ha used with seed treated with PRO GRO plus methyl cellulose increased yields on cv Fortress (Table 3) but no treatments increased the yields of Taurus compared to the untreated check. Using PRO GRO treated seed in conjunction with DITHANE did not significantly improve control of onion smut, especially at the high (8.8 kg/ha) rate.

Table 1. Evaluation of DITHANE DG, DITHANE M-22 and PRO GRO on onion smut on cv Fortress the Muck Crops Research Station in 1997.

Treatments	Rate of Product	Incidence of Smut % 16 Jun	 14 Jul	 15 Sep	
Check		54.7 de *	22.9 bc	18.3 bc	
DITHANE DG	4.4 kg/ha	31.0	c 7.4	a	5.4ab
DITHANE DG	8.8 kg/ha	20.3 abc	8.0 ab	4.7 ab	
PRO GRO + methyl cellulose	25 g/kg seed	13.5 abc	13.4 ab	6.7 ab	
DITHANE M-22	5.67 kg/ha/1000 L	18.9 abc	14.3 ab	10.5 ab	
DITHANE M-22 + PRO GRO + methyl cellulose	5.67 kg/ha/1000 L 25 g/kg seed	8.8 ab	6.9 a	5.9 ab	
DITHANE DG	5.6 kg/ha	27.3	bc 11.9	ab	7.4ab
DITHANE DG PRO GRO + methyl cellulose	+ 4.4 kg/ha 25 g/kg seed	7.2 ab	5.6 a	4.2 ab	
DITHANE DG + PRO GRO + methyl cellulose	8.8 kg/ha 25 g/kg seed	5.3 a	1.4 a	1.9 a	

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 2. Evaluation of DITHANE DG, DITHANE M-22 and PRO GRO for onion smut control on cv Taurus at the Muck Crops Research Station in 1997.

Treatments	Rate of Product	Incidence of Smut (%) 16 Jun	 14 Jul	 15 Sep
Check		45.4 c *	26.4 c	26.6 d
DITHANE DG	4.4 kg/ha	28.3 abc	8.8 ab	4.2 ab
DITHANE DG	8.8 kg/ha	21.7 ab	5.2 a	3.3 a
PRO GRO + methyl cellulose	25 g/kg seed	20.5 ab	15.4 ab	16.5 a-d
DITHANE M-22	5.67 kg/ha/1000 L	18.9 ab	10.1 ab	17.2 bcd
DITHANE M-22 + PRO GRO + methyl cellulose	5.67 kg/ha/1000 L 25 g/kg seed	7.8 a	4.8 a	4.5 ab
DITHANE DG	5.6 kg/ha	32.9 bc	9.2 ab	10.2 abc
DITHANE DG PRO GRO + methyl cellulose	+ 4.4 kg/ha 25g/kg seed	6.1 a	3.2 ab	5.8 ab
DITHANE DG PRO GRO + methyl cellulose	+ 8.8 kg/ha 25 kg/seed	7.3 a	5.8 ab	5.8 ab

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 3. Yield data in kilograms from 7 meters of row for Fortress and Taurus at the Muck Crops Research Station in 1997.

Treatments	Rate of Product	Yield (kg/7 m) Fortress	Taurus
Check		30.7 abc *	30.1 ab
DITHANE DG	4.4 kg/ha	33.2 abc	31.5 ab
DITHANE DG	8.8 kg/ha	30.3 abc	27.9 b
PRO GRO + methyl cellulose	25 g/kg seed	34.4 ab	30.5 ab
DITHANE M-22	5.67 kg/ha/1000 L	34.2 ab	38.2 a
DITHANE M-22 + PRO GRO + methyl cellulose	5.67 kg/ha/1000 L 25g/kg seed	29.8 abc	30.8 ab
DITHANE DG PRO GRO + methyl cellulose	+ 4.4 kg/ha 25 g/kg seed	32.8 abc	33.3 ab
DITHANE DG + PRO GRO + methyl cellulose	8.8 kg/ha 25 g/kg seed	25.0 c	30.7 ab

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR # 95 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR#: 206003

CROP: Yellow cooking onions cv Benchmark
PEST: Botrytis Leaf Blight *(Botrytis squamosa* Walker)

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TITLE: EFFICACY OF THE FUNGICIDE PENNCOZEB 75DF FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT ON ONIONS, 1997

MATERIALS: BRAVO 500 (chlorothalonil 50%) DITHANE DG (mancozeb 75%) PENNCOZEB 75DF (mancozeb 75%) ROVRAL (iprodione 50%) ZINEB (zineb 80%)

METHODS: Onions were seeded into organic soil at the Muck Crops Research Station on 2 May at a rate of 36 seeds/m. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 8 rows (42 cm apart), 5 m in length. Treatments were applied 14, 13 Jul, 7, 13, and 26 Aug using a pull-type plot sprayer with TeeJet D-3 hollow cone nozzles at 100 psi (boom) in 500 L/ha of water. PENNCOZEB 75DF at 2.25 kg/ha was applied at each spray. ROVRAL at 0.75 kg/ha was applied with the PENNCOZEB 75 DF for the 13 and 26 Aug sprays. Conventional treatments BRAVO 500 at 3.5 L/ha, DITHANE DG at 2.25 kg/ha and ZINEB at 2.25 kg/ha were applied on 23 Jul, 7 Aug, 14 Jul, 13 Aug, 26 Aug, respectively as recommended in Ontario Ministry of Agriculture, Food and Rural Affairs Publication #363, 1996/1997 Vegetable Production Recommendations. Twenty-five plants per replicate were harvested on 10 Sep when the plants were near maturity. The three lower leaves with 80% or more of non-necrotic tissue were rated for the percentage of green tissue area using The Manual of Assessment Keys for Plant Disease by Clive James, Key No. 1.6.1. The total number of dead and green leaves were also recorded. A harvest yield of 4.66 m was taken of 6 Oct. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Tables 1 and 2.

CONCLUSIONS: Severity of botrytis leaf blight was low in 1997 and there were no differences in overall disease ratings or yield between fungicide treated and untreated onions (Table 1). When infected leaves were divided into severity classes, onions subjected to the conventional spray program had the greatest number of leaves in the class (0-2%) with the lowest disease severity (Table 2). Frequency of disease on onions sprayed with PENNCOZEB 75 DF was not different from those from the conventional spray program or the untreated control.

Table 1. Evaluation of PENNCOZEB 75DF for the control of Botrytis Leaf Blight on the three oldest green leaves, 1997.

Treatment	Green Tissue percent/ 25 plants	Total # dead leaves/ 25 plants	Total # green leaves/ 25 plants	Harvest Yield (kg) 4.33 m
PENNCOZEB 75DF	80.0 a *	68 a	214 a	11.79 a
Conventional	80.0 a	108 a	194 a	10.27 a
Control	80.0 a	89 a	203 a	9.09 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 2. Effect of fungicide regimes on frequency of onion leaves with different levels of disease severity.

	Percent of leaf area infected				
Treatment	0-2%	2-5%	5-10%	10-15%	15-20%
PENNCOZEB 75DF	56.25 ab *	37.5 a	6.25 a	0 a	0 a
Conventional	82.5 a	16.25 a	1.25 a	0 a	0 a
Control	30. b	36. a	25. a	8 a	1.25 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 96 **SECTION I: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR#: 206003

CROP: Yellow cooking onions, cv. Fortress and Taurus
PEST: Onion Smut *(Urocystis cepulae* Frost)

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TITLE: EVALUATION OF FUNGICIDE SEED AND FURROW TREATMENTS FOR THE CONTROL OF ONION SMUT, 1997

MATERIALS: PRO GRO (carbathiin 30%, thiram 50%), methyl cellulose, BAYTAN (triadimenol 32%), VITAVAX (carbathiin 97%), DITHANE DG (mancozeb 75%), DIVIDEND (difenoconazole 32.8%)

METHODS: Raw onion seed from cvs. Fortress and Taurus were treated with fungicides on 1 May. The treatments consisted of: 1) PRO GRO applied at 25 g of product per kg of seed as a sticker; 2) PRO GRO applied at 25 g of product with 1% methyl cellulose per kg of seed; 3) DIVIDEND applied at 94 g/ha. Additional treatments consisted of onion seed previously treated with PRO GRO at 25 g of product plus 1% methyl cellulose per kg of seed with one of the following: a) BAYTAN applied at 0.6 g/m of row; b) BAYTAN applied at 1.2 g/m of row; c) VITAVAX applied at 0.6 g/m of row; d) VITAVAX applied at 1.2 g/m of row, e) DITHANE DG applied at 4.4 kg/ha. Raw onion seed was also seeded with DITHANE DG at 4.4 kg/ha. An untreated check was also included. The trial was seeded on 12 and 13 May in organic soil naturally infested with onion smut (pH 6.4, organic matter 60%) at the Muck Crops Research Station in 1997. A randomized complete block arrangement with four blocks per replicate was used. Each replicate consisted of 2 rows (43 cm apart) cv Fortress and 2 rows (43 cm apart) cv Taurus, 5 m in length. Treatments were seeded using a V-belt push seeder delivering a random spacing and depth at 1.5 to 2.0 cm. BAYTAN, VITAVAX and DITHANE DG was applied to the seed furrow by placing the fungicide on the V-belt with the seed. Germination counts were taken 2, 5, 9, and 12 Jun from each of the three 1 m sections of each cultivar in all the treatments. When the onions reached one true leaf (16 Jun) a 1 m section of row was harvested, washed and evaluated for incidence of smut. A second 1 m sample was taken on 10 Jul. A final evaluation of smut was made at harvest on 9 and 12 Sep. Harvest weight was taken from the remaining 7 m of onions on 26 Sep. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Tables 1, 2 and 3.

CONCLUSIONS: Several of the fungicide treatments significantly (P=0.05) reduced the incidence of smut and increased yields compared to the untreated control. Dividend at a rate of 94 g/ha did not effectively control smut (Tables 1 and 2). PRO GRO applied in combination with methyl cellulose reduced the incidence of smut on both cultivars of onions and was as effective as any of the other treatments (Tables 1 and 2). Smut control did not improve when PRO GRO treated seed was used in combination with other fungicides. On cv Fortress, only PRO GRO plus VITAVAX increased yield compared to the untreated check (Table 3). On cv Taurus, all fungicides provided a significant (P=0.05) yield increase except PRO GRO without methyl cellulose, DIVIDEND and DITHANE DG alone compared to the check.

Table 1. Evaluation of fungicide seed and furrow treatments for the control of onion smut on cultivar Fortress, 1997.

	Incidence of Smut %		
Treatments	16 Jun	10 Jul	12 Sep
Check	49.2 a *	28.2 ab	20.3 de
PRO GRO 25 g/kg	26.5 b	27.1 ab	15.8 cde
PRO GRO 25 g/kg + methyl cellulose	11.4 bc	13.4 cd	13.0 bcd
PRO GRO 25 g/kg + methyl cellulose + BAYTAN 0.6 g/m	17.1 bc	19.4 bc	16.0 cde
PRO GRO 25 g/kg + methyl cellulose + BAYTAN 1.2 g/m	16.3 bc	15.4 cd	8.0 bc
PRO GRO 25 g/kg + methyl cellulose + DITHANE DG at 4.4 kg/ha (0.176 g/m)	10.8 c	4.0 d	4.5 a
DITHANE DG 4.4 kg/ha (0.176 g/m)	13.9 bc	7.5 d	5.8 a
PRO GRO 25 g/kg + methyl cellulose + VITAVAX 0.6 g/m	11.0 bc	14.7 cd	13.5 bc
PRO GRO 25 g/kg + methyl cellulose + VITAVAX 1.2 g/m	9.4 c	9.8 cd	12.3 bc
DIVIDEND 94g/ha	53.1 a	31.4 a	26.8 e

* Numbers in column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 2. Evaluation of fungicide seed and furrow treatments for the control of onion smut on cv. Taurus, 1997.

	Incidence of Smut %		
Treatments	16 Jun	10 Jul	12 Sep
Check	41.0 b *	47.9 d	39.8 c
PRO GRO 25 g/kg	18.6 a	15.9 ab	25.5 abc
PRO GRO 25 g/kg + methyl cellulose	16.2 a	16.3 b	7.3 ab
PRO GRO 25 g/kg + methyl cellulose + BAYTAN 0.6 g/m	12.1 a	11.3 a	22.5 abc
PRO GRO 25 g/kg + methyl cellulose + BAYTAN 1.2 g/m	14.7 a	24.4 cd	17.8 abc
PRO GRO 25 g/kg + methyl cellulose + DITHANE DG 4.4 kg/ha (0.176 g/m)	5.7 a	6.5 a	8.3 ab
DITHANE DG 4.4 kg/ha (0.176 g/m)	12.8 a	14.5 ab	9.8 abc
PRO GRO 25 g/kg + methyl cellulose + VITAVAX 0.6 g/m	7.0 a	12.9 ab	12.8 ab
PRO GRO 25 g/kg + methyl cellulose + VITAVAX 1.2 g/m	8.2 a	11.2 a	6.5 a
DIVIDEND 94 g/ha	43.9 b	32.8 c	28.0 bc

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Table 3. Yield data in kg from 7 m of row for both cultivars Fortress and Taurus, 1997.

	Yield (kg/m)	
Treatments	Fortress	Taurus
Check	26.7 b	23.0 c
PRO GRO 25 g/kg	30.6 b	26.7 bc
PRO GRO 25 g/kg + methyl cellulose	31.1 b	29.5 ab
PRO GRO 25 g/kg + methyl cellulose + BAYTAN 0.6 g/m	30.7 b	29.2 ab
PRO GRO 25 g/kg + methyl cellulose + BAYTAN 1.2 g/m	27.8 b	31.2 ab
PRO GRO 25 g/kg + methyl cellulose + DITHANE DG 4.4 kg/ha (0.176 g/m)	29.6 b	31.0 ab
DITHANE DG 4.4 kg/ha (0.176 g/m)	28.6 b	25.1 bc
PRO GRO 25 g/kg + methyl cellulose + VITAVAX 0.6 g/m	31.3 b	30.4 ab
PRO GRO 25 g/kg + methyl cellulose + VITAVAX 1.2 g/m	40.9 a	33.2 a
DIVIDEND 94 g/ha	26.5 b	25.9 bc

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

END OF SECTION I

SECTION J - DISEASES OF POTATOES /MALADIES DE POTATES

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Section Editor - Agnes Murphy

PMR REPORT # 97 **SECTION J: DISEASES OF POTATOES**

CROP: Potato (*Solanum tuberosum*), cv. Russet Burbank
PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

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TITLE: EFFICACY OF FOLIAR KOCIDE FUNGICIDE COMBINATIONS FOR THE CONTROL OF LATE BLIGHT ON POTATOES.

MATERIALS: KOCIDE DF (copper hydroxide 61.45%), KOCIDE 2000 (copper hydroxide 53.8%), DITHANE DG (mancozeb 75%), BRAVO (chlorothalonil 500g/L)

METHODS: The trial was conducted in 1997 at Portage la Prairie, Manitoba. Plots of 2 rows (12 m long with 0.96 m row spacing) were arranged in a RCB design. Treatments were replicated four times. Plots were separated by 2 buffer rows for tractor operation. Fertilizer was broadcast (110 kg N/ha as urea, 44 kg P_2O_5/ha as ammonium phosphate) and incorporated with a field cultivator prior to planting. Fungicides were mixed with water (pH 8.4) and applied at the product rates stated in Table 1. Application was made through a 2 m wide boom at 225 l/ha using Teejet TXVS-8 hollow cone nozzles at 275 kpa using CO_2 as the propellant. The fungicide was applied to the two rows immediately beside the tractor. Application dates for all treatments were made on July 17 (#1), 24 (#2) and 31 (#3), August 11 (#4), 19 (#5) and 26 (#6), and on September 9 (#7) and 18 (#8). Potato vines were dessicated on September 22 using Reglone (diquat 200 g ai/l) at 2.5 l/ha. On September 26 (#9) and October 3 (#10), only treatments containing either KOCIDE DF or KOCIDE 2000 were applied. All treatments were visually evaluated for late blight symptoms on four dates prior to dessication. The entire plot was harvested and graded for yield with tubers being stored for disease assessment.

RESULTS: Results are summarized in Table 1. Plants remained unaffected by late blight until September at which time disease spread rapidly throughout the untreated check. All treatments reduced late blight severity compared to the untreated check. On September 22, BRAVO provided better control than both rates of KOCIDE DF and the low rate of KOCIDE 2000. The low rate of KOCIDE DF was less effective at controlling late blight than all other treatments except for the low rate of KOCIDE 2000.

All treatments except for the low rates of KOCIDE DF, KOCIDE 2000 and the mixture of KOCIDE DF and DITHANE DG increased the total marketable yield of potatoes compared to the untreated check. The combination of KOCIDE DF and BRAVO produced a larger yield of marketable tubers than these treatments. Application of the high rate of KOCIDE 2000 resulted in a higher yield of marketable tubers compared to application of the low rate. All treatments increased the yield of large tubers significantly compared to the untreated check. The treatments containing BRAVO produced more large tubers than the low rates of KOCIDE DF, KOCIDE 2000 and the mixture of KOCIDE DF + DITHANE DG.

CONCLUSIONS: Applications of the high rates of KOCIDE DF, KOCIDE 2000 and KOCIDE DF + BRAVO throughout the growing season resulted in a marketable yield at least as high as that of the standard treatments of DITHANE DG and BRAVO. When the lower rates of KOCIDE were applied alone or in combination with DITHANE DG throughout the growing season, marketable yield of potato tubers was not significantly higher than the untreated check.

Table 1. The effect of KOCIDE fungicide combinations on severity of late blight and subsequent potato tuber yield.[1]

Treatment Rate (Application #)	Late Blight Severity (%)		Tuber Yields (t/ha)		
	15/09/97	22/09/97	<55 mm	>55 mm	Total
KOCIDE DF 1.7 kg/ha (1-8) KOCIDE DF 3.4 kg/ha (9-10)	7.5 b	30.0 b	6.3 b	21.4 bc	27.8 b-e
KOCIDE DF 3.4 kg/ha (1-10)	3.5 b	18.8 cd	5.9 b	23.4 abc	29.3 a-d
KOCIDE 2000 2.24 kg/ha (1-8) KOCIDE 2000 3.4 kg/ha (9-10)	4.8 b	25.0 bc	5.9 b	21.2 bc	27.2 cde
KOCIDE 2000 3.4 kg/ha (1-10)	3.5 b	16.3 cde	6.2 b	24.2 ab	30.5 ab
KOCIDE DF 1.7 kg/ha + DITHANE DG 1.75 kg/ha (1-8) KOCIDE DF 3.4 kg/ha (9-10)	2.8 b	17.5 cde	6.0 b	20.2 c	26.2 de
KOCIDE DF 1.7 kg/ha + BRAVO 1.75 l/ha (1-8) KOCIDE DF 3.4 kg/ha (9-10)	1.8 b	11.8 de	6.1 b	25.5 a	31.6 a
DITHANE DG 2.25 kg/ha (1-8)	3.0 b	14.3 de	7.1 ab	22.9 abc	30.0 abc
BRAVO 2.4l/ha (1-8)	1.3 b	8.0 e	5.4 b	24.9 a	30.3 ab
Untreated check	75.0 b	95.0 a	8.4 a	16.5 d	24.9 e
P• 0.05	s[2]	s	ns[2]	s	s
Coefficient of Variation (%)	39.0	25.7	19.9	9.9	7.4

[1] Values are the mean of four replicates. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

[2] s - Statistically significant.
ns - Not statistically significant.

PMR REPORT # 98 **SECTION J: DISEASES OF POTATOES**

CROP: Potato (*Solanum tuberosum*), cv. Russet Burbank
PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

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TITLE: **EFFICACY OF FOLIAR APPLIED FUNGICIDES FOR THE CONTROL OF LATE BLIGHT ON POTATOES**

MATERIALS: MANZATE 200 (mancozeb 75%), CURZATE M-8 (mancozeb 64%, cymoxanil 8%), CURZATE 60 (60% cymoxanil), DITHANE DG (mancozeb 75%), BRAVO (chlorothalonil 500g/L)

METHODS: The test was conducted in 1997 at Portage la Prairie, Manitoba. Plots of 2 rows (12 m long with 0.96 m row spacing) were arranged in a RCB design. Treatments were replicated four times. Plots were separated by 2 buffer rows for tractor operation. Fertilizer was broadcast (110 kg N/ha as urea, 44 kg P_2O_5/ha as ammonium phosphate) and incorporated with a field cultivator prior to planting. Fungicides were mixed with water (pH 8.4) and applied at the product rates stated in Table 1. Application was made through a tractor-mounted 2 m wide boom at 225 l/ha using Teejet TXVS-8 hollow cone nozzles at 275 kpa using CO_2 as the propellant. The fungicide was applied to the two rows immediately beside the tractor. Application dates for all treatments were July 17 (#1), 24 (#2) and 31 (#3), August 11 (#4), 19 (#5) and 26 (#6), and on September 9 (#7) and 18 (#8). Potato vines were desiccated on September 22 using diquat (200 g ai/l) at 2.5 l/ha. All treatments were visually evaluated for late blight severity on four dates prior to desiccation. The entire plot was harvested and graded for yield with tubers being stored for disease assessment.

RESULTS: Results are summarized in Table 1. Plants remained unaffected by late blight until September at which time disease spread rapidly throughout the untreated check. On all assessment dates treatments reduced late blight severity compared to the untreated check. Treatment differences were not apparent until September 22 when all three MANZATE/CURZATE treatments showed greater control of late blight compared to DITHANE DG. Total marketable tuber yield was higher for all treatments when compared to the untreated check. The yield of large-sized tubers was less for the untreated check than for the other treatments. The treatment of MANZATE 200 @1.68 kg ai/ha and MANZATE 200 @ 1.5 kg ai/ha + CURZATE 60 @ 135 g ai/ha produced more large tubers than DITHANE DG, the untreated check and the treatment of MANZATE 200 @1.68 kg ai/ha and CURZATE M-8 @ 1.2 kg ai/ha. The untreated check produced more medium-sized tubers than all treatments except for DITHANE DG.

CONCLUSIONS: All MANZATE/CURZATE treatments were at least as effective as the standard treatment BRAVO for control of late blight and significantly better compared to DITHANE DG. Application of all fungicide treatments provided a yield advantage compared to the untreated check.

Table 1. The effect of MANZATE/CURZATE fungicide combinations on severity of late blight and subsequent potato tuber yield.[1]

Treatment (Application #)	Late Blight Severity (%)		Potato Tuber Yield (t/ha)		
	Sept. 15	Sept. 22	<55 mm	>55 mm	Total
MANZATE 200 1.68 kg ai/ha (1-2) CURZATE M-8 1.2 kg ai/ha (3-4) MANZATE 200 1.68 kg ai/ha (5) CURZATE M-8 1.2 kg ai/ha (6-7) MANZATE 200 1.68 kg ai/ha (8)	1 b	7 c	6.3 ab	22.7 b	29.1 a
MANZATE 200 1.68 kg ai/ha (1-2) CURZATE 60 112 g ai/ha + MANZATE 200 1.5 kg ai/ha (3-4) MANZATE 200 1.68 kg ai/ha (5) CURZATE 60 112 g ai/ha + MANZATE 200 1.5 kg ai/ha (6-7) MANZATE 200 1.68 kg ai/ha (8)	1 b	4 c	6.1 b	25.6 ab	31.7 a
MANZATE 200 1.68 kg ai/ha (1-2) CURZATE 60 135 g ai/ha + MANZATE 200 1.5 kg ai/ha (3-4) MANZATE 200 1.68 kg ai/ha (5) CURZATE 60 135 g ai/ha + MANZATE 200 1.5 kg ai/ha (6-7) MANZATE 200 1.68 kg ai/ha (8)	1 b	3 c	5.2 b	26.8 a	32.0 a
DITHANE DG 2.25 kg/ha (1-8)	3 b	14 b	7.1 ab	22.9 b	30.0 a
BRAVO 2.4l/ha (1-8)	1 b	8 bc	5.4 b	24.9 ab	30.3 a
Untreated check	75 a	95 a	8.4 a	16.5 c	24.9 b
P• 0.05	s[2]	s	s	s	s
Coefficient of Variation (%)	38.4	21.1	21.8	10.9	7.5

[1] Values are the mean of four replicates. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

[2] s - Statistically significant.

PMR REPORT # 99 **SECTION J: DISEASE OF POTATOES**
ICAR: 96005056

CROP: Potatoes (*Solanum tuberosum*, L.), cv. Green Mountain
PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

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TITLE: FUNGICIDE EFFICACIES FOR CONTROL OF POTATO LATE BLIGHT IN 1996

MATERIALS: Beginning on 11 July, the following treatments were applied: chlorothalonil (BRAVO 500 and BRAVO WS; 40% EC; ISK- Biosciences) at 0.8 litres a.i. ha^{-1} every 7 days; chlorothalonil (BRAVO 500) at 0.8 litres a.i. ha^{-1} every 7 days but with metalaxyl and mancozeb (RIDOMIL MZ; 72% WP; Novartis) at 1.8 kg a.i. ha^{-1} on 3 occasions beginning on 12 July and repeated every 14 days; chlorothalonil (BRAVO 500) at 0.8 litres a.i. ha^{-1} every 7 days but with propamocarb and chlorothalonil (TATTOO C; 75% EC; AgrEvo) at 2.0 litres a.i. ha^{-1} on 3 occasions beginning on 18 July and repeated every 14 days; copper hydroxide (KOCIDE 101; 72% WP; Griffin) at 1.68 kg a.i. ha^{-1} every 7 days; copper hydroxide (KOCIDE 101; 72% WP; Griffin) plus mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.68 kg a.i. ha^{-1} and 1.75 kg a.i. ha^{-1} respectively, every 7 days; FLUAZINAM (FLUAZINAM; 40% EC; ISK- Biosciences) at 0.8 litres a.i. ha^{-1} every 7 days; mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.75 kg a.i. ha^{-1} every 7 days; mancozeb and cymoxanil (CURZATE M8; 72% WP; Dupont) at 1.0 kg a.i. ha^{-1} every 7 days; mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.75 kg a.i. ha^{-1} every 7 days but with dimethomorph and mancozeb (ACROBAT MZ; 72% WP; Cyanamid) 1.8 kg a.i. ha^{-1}, respectively, applied on 3 occasions beginning 18 July and repeated every 14 days or applied on 18 July and on 5 September; mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.75 kg a.i. ha^{-1} every 7 days but with metalaxyl + mancozeb (RIDOMIL MZ; 72% WP; Novartis) at 1.8 kg a.i. ha^{-1} on 3 occasions beginning on 12 July and every 14 days; mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.75 kg a.i. ha^{-1} every 7 days but with metalaxyl + mancozeb (RIDOMIL GOLD; 68% WP; Novartis) at 1.7 kg a.i. ha^{-1} on 3 occasions beginning on 12 July and every 14 days; and triphenyltin hydroxide (SUPERTIN; 80% WP; Griffin) plus mancozeb (DITHANE 75% DG; Rohm & Haas) at 0.2 kg and 1.75 kg a.i. ha^{-1}, respectively, every 7 days. Untreated control plots did not receive any fungicides.

METHODS: For each treatment, four replicate plots consisting of three rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1996 in two studies, A and B, comprised of different treatments. All three-row plots were separated by untreated plants for tractor operations and/or inoculation. Whole (35-55 mm), green-sprouted, Elite 3 seed tubers (cv. Green Mountain) were planted 30 cm apart and recommended crop management practices were followed. Plant emergence counts on the centre row of each three-row plot were made 40-50 days post-planting. A sporangial suspension of *P. infestans* was applied to the foliage of plants in the inoculated rows of each plot 2-4 days after the first fungicide application. Plots were mist irrigated (3-5 mm hr^{-1} for 2-4 hr periods) on 4 occasions during July to maintain disease development in the inoculated rows. Late blight incidence (amount of diseased foliage as a percentage of total plant foliage) in plants in the centre row of each plot were made throughout August and September. Fungicides were applied (tractor-mounted sprayer modified to spray only the centre three rows with three hollow-cone according to the treatment application schedule. Top desiccant was applied mid-late September, two weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (% by weight) were determined. All data were subjected to analysis of variance with arcsin transformation of percent data and area under disease progress curves calculated before analyses.

RESULTS: Plant emergence was 100% in all plots. Foliar late blight damage was 100% in untreated plots by 13 August due to an exceptionally rapid disease development rate (Table 1). Some fungicide treatments (eg. DITHANE and FLUAZINAM) had good control of foliar late blight until 13 August. However, wet weather and high inoculum levels resulted in disease control failures during the next two weeks. Many fungicide treatments had significantly higher tuber yields than the untreated but late blight tuber rot occurrence was minimal in all plots.

CONCLUSIONS: Most of the fungicides tested prevented foliar damage due to late blight for part of the season. However, when disease pressures became high, the application intervals should have been reduced as disease control was lost at the fixed intervals set for moderate disease pressure. Further evaluation of these fungicide treatments are required to confim these results.

Table 1. Fungicide efficacies for control of late blight and effect on potato yields in 1996.

			Late Blight		Tuber Yield	
Foliar Treatment	Rate (a.i. ha^{-1})	Appl. No.^	Foliar 13 Aug.	AUDPC* 5 Sep.	> 55mm (t/ha)	Total (t/ha)
Study A						
BRAVO 500	0.8 L	9	13	30	20.4	32.1
CURZATE M8	1.0 kg		8	31	14.7	27.0
DITHANE	1.8 kg	9	6	24	20.4	32.1
DITHANE & RIDOMIL MZ	1.8 & 1.8 kg	9&3	13	30	17.3	28.9
KOCIDE 101	1.7 kg	9	61	63	10.9	24.4
KOCIDE 101 + DITHANE	1.7 + 1.8 kg	9	35	53	16.5	28.3
SUPERTIN + DITHANE	0.2 + 1.8 kg	9	8	24	22.2	33.3
UNTREATED	-	-	100	92	3.5	16.2
SED (95 df)	-	-	5.9	3.3	1.47	1.44
Study B						
ACROBAT MZ & DITHANE	1.8 & 1.8 kg	3&9	10	26	20.6	33.2
ACROBAT MZ & DITHANE	1.8 & 1.8 kg	2&9	15	30	15.9	28.9
BRAVO WS	0.8 L	9	11	32	17.9	30.8
DITHANE	1.8 kg	9	6	24	20.4	32.1
FLUAZINAM	0.8 L	9	4	16	22.6	36.2
RIDOMIL MZ & BRAVO	1.8 kg&0.8 L	3&9	9	27	21.6	34.5
RIDOMIL MZ & DITHANE	1.8 & 1.8 kg	3&9	13	30	17.3	28.9
RIDOMIL GOLD & DITHANE	1.7 & 1.8 kg	3&9	11	33	13.5	25.1
TATTOO C & BRAVO	2.0 & 0.8 L	3&9	9	27	17.8	30.5
UNTREATED	0	0	100	86	4.5	16.3
SED (139 df)	-	-	2.8	3.1	1.59	1.71

* AUDPC = relative area under disease progress curve.

^ Appl. No. = Number of foliar applications per fungicide for treatments with either one or two fungicides.

REPORT # 100 **SECTION J: DISEASES OF POTATOES**

CROP: Potato, cv. Shepody
PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

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TITLE: EFFICACY OF CURZATE AND MANZATE AGAINST LATE BLIGHT ON POTATOES, 1997

MATERIALS: MANZATE 200 (mancozeb 75% DF), CURZATE M8 (8% cymoxanil + 64% mancozeb DF), CURZATE (60% cymoxanil DF) in a tankmix with MANZATE, and BRAVO 500 (500 g/L chlorothalonil EC).

METHODS: Cut pieces of Shepody potatoes (Elite III) were planted using a single row planter on May 22, 1997 in a silt loam soil at Abbotsford, B.C. Experimental plots were 5.5 m long and 1.8 m wide (2 rows). Plots were separated by 1 m bare ground. The experiment was conducted as a RCBD with 4 replications. Fungicides were applied in a volume of 300 L/ha using a hand-held sprayer with flat-fan nozzles beginning June 30 and ending on August 26. Isolates from infected leaves were identified at Simon Fraser University in Burnaby, B.C. Plots were hilled on June 19. The trial was irrigated on July 26, August 2 and 13 with overhead sprinklers. Late blight was rated on August 14 and 27 using key no. 3.1.2 (Can. Plant Dis. Surv. 51: 60). The crop was dessicated on September 1 with REGLONE and harvested on September 10. Yield of potatoes was recorded. All analyses were based on untransformed data. Means were separated using Duncan's multiple range test.

RESULTS: May, June and the first week of July were very wet. Precipitation in this period varied from above normal to record breaking, and was approximately twice the normal amount. Precipitation during the remainder of July and August was about normal with above normal temperatures.

The wet spring started an early epidemic of late blight in many commercial fields. In the trial, the first symptoms of late blight were observed on July 16. Late blight progressed rapidly in the untreated control. Infection levels were low in the treated plots on August 14 (Table 1), but were higher on August 27. Treatments with rotations of CURZATE and MANZATE slowed the progress of late blight more than the treatment with BRAVO. The isolate was identified as g-11, which is a metalaxyl-insensitive, A1 isolate.

Protective treatment with BRAVO yielded up to 175% more than the untreated check (Table 1). Treatments with CURZATE/MANZATE yielded up to 27% more than the BRAVO treatment.

CONCLUSIONS: All treatments reduced the foliar infection and increased the tuber yield. CURZATE provided the best protection and gave the largest increase in tuber yield.

Table 1. Rating of late blight on potato leaves, tuber yield and application dates for each treatment.

Treatments		Disease rating			
(Chemicals used in rotation)	Rate	Aug 14	Aug 27	Tuber yield	Application dates
	kg/ha L/ha	%	%	t/ha	
Untreated	--	95a	100a	16.4c	--
BRAVO 500	2.4	26b	45b	44.9b	6/30, 7/5, 7/11, 7/16, 7/24, 8/1, 8/10, 8/19, 8/26
CURZATE M8	1.7	4c	3c	52.2ab	7/11, 7/16, 8/1, 8/10
MANZATE 200	2.25				6/30, 7/5, 7/24, 8/19, 8/26
MANZATE 200 + CURZATE	2.0 1.9	4c	15c	56.9a	7/11, 7/16, 8/1, 8/10
MANZATE 200	2.25				6/30, 7/5, 7/24, 8/19, 8/26
MANZATE 200 + CURZATE	2.0 2.25	4b	4b	53.5a	7/11, 7/16, 8/1, 8/10
MANZATE 200	2.25				6/30, 7/5, 7/24, 8/19, 8/26
LSD(0.05)		13	23	7.8	

END OF SECTION J

SECTION K - CEREALS, FORAGE CROPS and OILSEEDS /CÉRÉALES, CULTURES FOURRAGÈRES ET OLÉAGINEUX

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Section Editor: Richard Martin

REPORT # 101 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE: 375-1122-9612

CROP: Barley, canola, pea, spring wheat
PEST: Cereal leaf spots, Septoria spp., *Pyrenophora teres*
Blackleg of canola, *Leptosphaeria maculans*
Ascochyta blight, *Mycosphaerella pinodes*

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TITLE: EFFECT OF FOLIAR APPLICATION OF AZOXYSTROBIN ON DISEASES OF PEA, CANOLA, WHEAT AND BARLEY IN 1997.

MATERIALS: QUADRIS (azoxystrobin, 250 g/l)

METHODS: A four year study was initiated at Saskatoon and Watrous, SK in 1997 to examine the impact of crop management systems on sustainability. Both trials were arranged in a split plot design with four replicates, with crop (= phase of rotation) as main plots. A crop rotation of spring wheat, canola, barley and field pea was used, with all phases of the rotation present in each year. Six management systems (combinations of cultivar, seeding rate and date, tillage system, fertilizer regimen, etc.) were the subplot treatments. One application of QUADRIS was made to one-half of each subplot; 125 g ai/ha at seedling stage in canola, 175 g ai/ha at early flowering in pea, and 125 g ai/ha at flag leaf emergence in cereals. Blackleg of canola was assessed in each sub-subplot at the rosette stage (incidence on 50 plants per sub-subplot) and at harvest (0-5 scale, 100 plants sub-subplot), ascochyta blight in pea at late bloom and pod filling (whole plot ratings, Horsfall-Barrett scale), and leaf spot of cereals at heading and seed filling. (whole plot ratings, Horsfall-Barrett scale).

Problems were encountered with stand establishment at the Saskatoon site, and one treatment was reseeded, resulting in delays in some fungicide applications. Fungicides were applied to canola on 24 June (or 14 July), to pea on 07 July (or 14 July) and to cereals on 07 July at Saskatoon. Blackleg ratings were made on 16 July and 18 August and ascochyta blight ratings on 22 July and 11 August. Cereal leaf spots were rated on 18 June (seedlings), 28 July and 11 August.

At Watrous, fungicide applications were made to canola on 17 June, to pea on 07 July and to cereals on 05 July. Blackleg ratings were made on 2 July and 6 August and ascochyta ratings on 16 July and 6 August. Cereal leaf spots were rated on 02 July (tillering), 16 July and 06 August. There was no history of pea or canola cultivation at this site, so pea and canola residue from nearby fields with epidemics of ascochyta blight and blackleg in 1996 were applied over the test area prior to seeding to ensure a source of inoculum.

RESULTS: Foliar disease severity ratings and seed yield of wheat are shown in Table 1.

CONCLUSIONS: At both sites, application of QUADRIS fungicide did not result in disease reduction or yield improvement within individual treatments for any crop (wheat, barley, canola or pea). However, when examined across all management treatments, fungicide application caused a slight reduction in foliar disease severity in wheat in the 28 July rating (late heading stage) at Saskatoon and a 6% increase in seed yield (P • 0.05, Table 1). At Watrous, fungicide application reduced foliar disease symptoms in wheat in the 16 July rating (heading)and increased seed yield by 7% (P • 0.05). The weather at both sites was extremely hot and dry throughout the summer and fall. Disease severity was well below normal in these trials, which may have reduced the impact of fungicide treatment. The trial will be continued for three more years.

Acknowledgement: Thanks to Zeneca and the Agri-Food Innovation Fund for support, and to Karyn Sutherland and Colleen Kirkham for technical assistance.

Table 1. Foliar disease severity (Horsfall-Barrett ratings) and seed yield (tonnes/ha) of spring wheat under six management systems, with (+) and without (-) foliar application of QUADRIS fungicide, at Saskatoon and Watrous, SK in 1997.

Management system	Fungicide	Disease Severity (HB)			Yield (T/ha)
		Rating 1†	Rating 2	Rating 3	
Saskatoon					
High herbicide/Zero tillage	-	1.0 a‡	3.0 ab	6.0 abc	2.46 ab
	+	1.0 a	2.0 a	5.3 a	2.48 ab
Medium herb./Zero tillage	-	1.8 b	4.0 a	6.5 bc	2.03 cd
	+	1.8 b	3.0 b	6.0 abc	2.11 bc
Low herbicide/Zero tillage	-	1.5 ab	3.8 b	6.8 bc	2.20 bc
	+	1.5 ab	3.3 ab	6.3 bc	2.49 ab
Low herbicide/Low tillage	-	1.8 b	4.0 a	6.8 bc	2.14 bc
	+	1.8 b	3.5 b	6.3 bc	2.21 bc
Medium herbicide/Medium tillage	-	1.0 a	3.0 ab	6.0 abc	2.36 abc
	+	1.0 a	2.5 ab	6.0 ab	2.36 a
No herbicide/High tillage	-	1.0 a	2.8 ab	6.0 abc	1.64 e
	+	1.0 a	2.0 a	6.3 b	1.72 de
Mean	-	**1.3**	**3.4 B**	**6.3**	**2.14B**
	+	**1.3**	**2.8 A**	**6.0**	**2.27A**
Watrous					
High herbicide/Zero tillage	-	1.6 abc	2.8 ab	6.3 a	2.22 ab
	+	1.4 abc	2.3 a	5.5 a	2.50 a
Medium herbicide/Zero tillage	-	1.7 c	3.5 b	6.8 a	2.07 ab
	+	1.6 abc	2.8 ab	7.0 a	2.40 a
Low herbicide/Zero tillage	-	1.6 abc	3.3 ab	5.3 a	2.23 ab
	+	1.6 abc	2.5 ab	5.0 a	2.48 a
Low herbicide/Low tillage	-	1.3 ab	3.5 b	6.8 a	2.08 ab
	+	1.3 ab	3.3 ab	6.5 a	1.93 b
Medium herbicide/Medium tillage	-	1.5 abc	3.3 ab	6.0 a	2.04 ab
	+	1.6 abc	2.5 ab	6.5 a	2.35 ab
No herbicide/High tillage	-	1.3 ab	3.0 ab	5.3 a	2.25 ab
	+	1.3 ab	2.5 ab	5.3 a	2.19 ab
Mean	-	**1.5**	**3.2 B**	**6.0**	**2.15 B**
	+	**1.5**	**2.6 A**	**6.0**	**2.31 A**

†Rated at Saskatoon on 18 June, 28 July and 11 August, at Watrous on 02 & 16 July and 06 August.

‡Means within a column, followed by the same letter, are not different based on LSD (P • 0.05)

PMR REPORT # 102 **SECTION K: CEREALS, FORAGE CROPS and OILSEEDS**
STUDY DATA BASE NUMBER: 375-1113-9613

CROP: Barley, *Hordeum vulgare* L. cultivars: Robust, Excel, Harrington, Tr133, Oxbow, B1602; Wheat, *Triticum aestivum* L. cultivars: AC Barrie, Katepwa

PEST: net blotch, *Pyrenophora teres* Drechs.(barley)
septoria complex, *Septoria tritici* Rob. in Desm. and *S. nodorum* (Berk.) Berk.
/tan spot, *Pyrenophora tritici-repentis* (Died.) Drechs. (wheat).

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TITLE: FUNGICIDE CONTROL OF FOLIAR LEAF SPOT PATHOGENS OF BARLEY AND WHEAT AT MELFORT, SASKATCHEWAN, IN 1997

MATERIALS: Propiconazole (TILT, 250 g ai/L, Ciba), Chlorothalonil (BRAVO, 500 g ai/L, ISK Bioscience).

METHODS: Cultivars were direct seeded into barley stubble with a Fabrow double disc press drill in plots 1.45 x 10 m. Fungicides were applied in 2 m strips to either end of the plots. The experimental design was a split-block, although fungicide treated and untreated areas were not randomized. Plots were seeded on May 16 with 22 kg ha^{-1} phosphate in furrow. Seeding rate targets were 230 plants m^{-2} of barley and 250 plants m^{-2} of wheat seeded into moisture to a depth of 2.0 cm without seed treatment. Propiconazole (0.5 L ha^{-1}) and Chlorothalonil (1.5 L ha^{-1}), both applied in 200 L ha^{-1} water were sprayed at the flag leaf stage and Chlorothalonil was applied at the same rate a second time 13 days later. Plots were rated for disease severity during the milk stage of kernel development using a 0 to 11 scale based on the percentage leaf area diseased. Yield measurements were made on single square metre harvest samples taken from the centre of the fungicide treated and untreated areas within each plot. Data were analysed using analysis of variance procedures.

RESULTS: Foliar diseases were visually identified as mainly the net form of net blotch of barley and the septoria complex and tan spot pathogens of wheat. Analysis of individual cultivars indicated Propiconazole treatments reduced the disease severity of all cultivars of barley except Robust, compared to the check (Table 1). Chlorothalonil reduced the disease severity of Tr133, Oxbow and B1602. However only Harrington sprayed with propiconazole showed a yield increase over the check.

Differences between fungicide application and the check for disease severity or yield of wheat cultivars were not observed (Table 1). There was a difference in yield for Barrie between Propiconazole and Chlorothalonil although neither treatment was different from the check.

CONCLUSIONS: Weather conditions at Melfort in 1997 were initially conducive to disease development, but lack of moisture during July reduced disease progress. Warm dry conditions of early August caused plants to ripen prematurely. Under these conditions Propiconazole and Chlorothalonil reduced disease symptoms of many of the barley cultivars examined but not the wheat cultivars. A yield increase was observed only on propiconazole treated Harrington barley.

Table 1. Disease rating (0-11 scale) and yield (kg/ha) of barley and wheat cultivars sprayed with propiconazole and chlorothalonil fungicides at Melfort, Saskatchewan, in 1997.

Cultivar	Propiconazole	Chlorothalonil	Check	$Lsd_{(0.05)}$
Disease rating				
Robust	7.3	7.8	8.5	1.3 ns
Excel	7.0	7.8	8.5	0.9 *
Harrington	9.0	10.3	10.5	1.0 *
Tr133	7.3	7.0	8.5	0.9 *
Oxbow	7.3	7.8	9.3	0.8 *
B-1602	8.0	8.5	9.5	0.6 *
AC Barrie	3.5	3.5	4.5	1.2 ns
Katepwa	3.5	3.8	3.8	1.0 ns
Yield				
Robust	4154	4049	3920	505 ns
Excel	5279	3923	4207	1472 ns
Harrington	3954	2942	2880	467 *
Tr133	3803	3459	3756	576 ns
Oxbow	4368	3969	4020	686 ns
B-1602	4547	3911	4386	801 ns
AC Barrie	3148	2801	3008	346 *
Katepwa	2950	2544	2552	487 ns

PMR REPORT # 103 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
Wheat, cv. Belvedere

PEST: Net blotch, *Pyrenophora teres* (barley)

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TITLE: INFLUENCE OF FOLIAR FUNGICIDES ON DISEASE AND YIELD IN BARLEY AND WHEAT, 1997

MATERIALS: TILT (propiconazole, 250EC), BAYLETON (triadimefon, 50WP), FOLICUR (hexaconazole, 39.1%)

METHODS: Barley and wheat plots were established on May 28, 1997, at a seeding rate of 300 and 400 viable seeds per m^2, respectively. Each plot was ten rows wide and five metres long, 17.8 cm between rows. Treatments were replicated four times in a randomized complete block design. Each barley plot was separated by an equal sized wheat plot, while wheat plots were separated by an equal sized barley plot. Plots received a herbicide application of MCPA (1L/ha) plus REFINE EXTRA (20g/ha). Fungicide applications were made as per the rate and timing indicated in Table 1, using a backpack CO2 small plot sprayer.

At Zadok's Growth Stage (ZGS) 80 net blotch was assessed on the penultimate leaf of 10 randomly selected tillers per plot using the Horsfall & Barratt Rating System. Disease severity in wheat never reached a level which warranted an assessment. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: Results of foliar application of fungicides on wheat and barley are presented in Table 1. While there was some control of net blotch in barley with TILT there was insufficient disease present in the plots, and the growth conditions such, that there was no effect of treatment on yield. Similarly there was no effect on wheat yields, with there being almost no foliar disease in the plots during critical stages of development.

CONCLUSIONS: Conditions in 1996 were not conducive to the development of foliar disease in either of the cereal cultivars under test. In barley, net blotch did not develop rapidly, nor did it reach very severe levels, as was evident from the disease ratings at ZGS 80. The season was also such that there was a tendency towards maximum yield potential and as such there was no significant effects on yield, in either wheat or barley, as a result of foliar application of fungicides.

Table 1. Efficacy of foliar fungicide treatments in barley and wheat, Charlottetown, PEI, 1997.

Treatment	Rate g ai/ha	Barley			Wheat	
		Net blotch (%)2nd leaf	Yield (kg/ha)	1000 kernel (g)	Yield (kg/ha)	1000 kernel (g)
Untreated Control		10.8	4280	48.3	4320	34.3
TILT	125	5.2	4270	48.2	4480	35.3
TILT	250	3.1	4490	49.0	4760	36.2
BAYLETON	125	8.4	4280	49.8	4620	34.8
BAYLETON	250	10.2	4530	48.7	4600	34.3
FOLICUR	125	7.9	4470	49.3	4810	35.8
FOLICUR	250	8.0	4550	47.9	4840	36.2
sem*		1.214	170.6	1.187	174.3	0.675
LSD (0.05)		3.6	NS**	NS	NS	NS

* sem = standard error of mean

** NS = not significant at a 0.05 level of probability

PMR REPORT # 104 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
PEST: Net blotch, *Pyrenophora teres*

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TITLE: INFLUENCE OF FUNGICIDE SEED TREATMENTS ON DISEASE AND YIELD IN BARLEY, 1997

MATERIALS: VITAFLO 280 (UBI2051-1, carbathiin 14.9%, thiram 13.2%), UBI2383-1 (BAYTAN 30, triadimenol 317 g/L), UBI2584-3 (RAXIL, 8.33 g/L), UBI2092-1 (VITAFLO 250, carbathiin 282 g/L), UBI2643 (TBZ, 333 g/L), UBI2379-1 (metalaxyl, 317 g/L), UBI2770 (carbathiin, 16.7%, thiabendazole, 1.5%, imazalil 1.2%), DIVIDEND 360F (difenconazole, 360 g/L), APRON XL (metalaxyl-m, 330 g/L), DIVIDEND XL RTA(difenconazole, 7.5 g/L, metalaxyl-m, 3.15 g/L), DIVIDEND XL (difenconazole, 183 g/L, metalaxyl-m, 15 g/L), PROSEED (hexaconazole, 5 g/L).

METHODS: Certified barley seed, cv. AC Sterling, was treated with the fungicides listed above at the rates listed in the table, in a small batch seed treater. Barley plots were established on May 28, 1997, at a seeding rate of 300 viable seeds per m^2. Each plot was ten rows wide and five metres long, 17.8 cm between rows. Treatments were replicated four times in a randomized complete block design, Each barley plot was separated by an equal sized wheat plot. Plots received a herbicide application of MCPA (1L/ha) plus Refine Extra (20g/ha).

At Zadok's Growth Stage (ZGS) 77 foliar net blotch was assessed on the penultimate leaf of 10 randomly selected tillers per plot using the Horsfall & Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: There was no effect of seed treatment on emergence. Disease severity was insufficient to warrant rating of the plots for seedling blight. There were no significant effect of any treatment on net blotch severity or on yield. The maximum yield benefit was with RAXIL at approximately 7%. Results of seed treatment on net blotch severity and yield are presented in Table 1.

CONCLUSIONS: Conditions in 1997 were not conducive to the development of net blotch. Net blotch did not develop rapidly, nor did it reach very sever levels, and as such there was no significant effect on disease severity or yield.

Table 1. Efficacy of fungicide seed treatments in barley, Charlottetown, PEI, 1997.

Treatment	Rate ml product/kg seed	Net blotch (%) 2nd leaf, Aug 5	Yield (kg/ha)	1000 kernel (g)	Test weight (kg/hl)
Untreated Control		10.0	4582	48.90	68.6
Vitaflo 280	2.30	14.2	4633	45.90	67.8
Vitaflo 280	3.30	7.3	4506	47.07	68.2
UBI2092-1	1.95	13.0	4610	48.60	68.2
UBI2092-1 + UBI2643 + UBI2379-1	1.95 + 0.105 + 0.063	19.0	4720	47.70	67.7
UBI2643	0.105	12.5	4532	48.05	67.4
UBI2379-1	0.063	13.4	4903	51.40	68.2
UBI2770	3.06	16.5	4583	47.65	67.7
UBI2584-3	1.80	11.7	4906	49.95	67.9
UBI2383-1	0.48	11.8	4865	48.35	67.9
DIVIDEND 360FS	0.33	16.9	4435	48.70	68.5
APRON XL	0.03	14.7	4482	49.15	67.5
DIVIDEND XL RTA	3.25	18.2	4795	50.35	67.9
DIVIDEND XL	0.65	14.2	4668	50.10	68.1
PROSEED	3.00	18.8	4584	47.65	67.1
PROSEED	4.00	12.7	4631	48.00	67.3
sem*		2.51	162.7	1.210	0.400
LSD (0.05)		NS**	NS	NS	NS

* sem = standard error of mean

** NS = not significant at a 0.05 level of probability

PMR REPORT # 105 **SECTION K:** **CEREALS, FORAGE CROPS AND OILSEEDS**

STUDY DATA BASE #: 385-1212-9503

CROP: Barley, cv. Harrington
PEST: Scald, *Rhynchosporium secalis* and net blotch, *Pyrenophora teres*

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TITLE: FOLIAR DISEASE DEVELOPMENT ON HARRINGTON BARLEY – LACOMBE 1997

MATERIALS: BAYTAN 30 (30% triadimenol), RAXIL (0.833% tebuconazole), TILT (25% propiconazole), VITAFLOW 280 (14.9% carbathiin plus 13.2% thiram)

METHODS: Harrington barley was treated with a small laboratory batch treater on May 2 at the following rates of g a i per kilogram of seed: BAYTAN 30 at 0.15 (low); BAYTAN 30 at 0.30 (high); RAXIL at 0.02; and VITAFLOW 280 at 0.55 carbathiin and 0.49 thiram. The test was seeded into worked barley stubble on May 14 in a 4 replication RCB design. Plots were 4 rows 5.5 m long with 23 cm row spacing. Two rows of wheat between plots limited plot interference. Emergence was counted in 2xl m portions of the centre rows on May 28. The number of leaves with lesions was recorded on June 11 in 2xl m portions of the centre rows. On June 11 dried straw with scald (*Rhynchosporium secalis*) lesions was spread evenly over the plot area. TILT was applied at 125 g a i /ha on June 26, when the plants were at Zadoks growth stage 39. Disease assessments of 10 tillers/plot were made on June 30, July 10, July 28 and August 8. The assessments were made on a scale of 0-9 were 0 = no disease and 9 = more than 50% leaf area diseased (PLAD) on the upper, middle and lower canopies. A 3 would rate: upper = 0, middle = 1 and lower = 10 PLAD; and 6 would rate: upper = 5, middle = 25-50 and lower > 50 PLAD. At each rating date, the presence of scald and net blotch (*Pyrenophora teres*) was noted. At maturity the whole plot was combine harvested and after drying, the cleaned grain was weighed and 1000 kernel weights determined.

RESULTS: The results are presented in Table 1. The application of seed dressings tended to reduce emergence, although there were no significant differences in emergence count. Treatments with BAYTAN 30 high had the lowest number of leaves with lesions at 4 weeks, followed by BAYTAN 30 low. At 6.5 weeks (June 30), there were no significant differences in disease score between any treatment, although treatments with VITAFLOW 280 had more scald and less net blotch. The disease ratings taken on July 10, July 24 and August 8 all showed significant differences. The trends were for lower scores and less scald in those treatments in which TILT had been applied. At July 24, BAYTAN 30 high without TILT showed a slower disease progression and more net blotch than other treatments without TILT. The treatment with no TILT and no seed dressing had the lowest yield and 1000 kernel weight and the application of TILT increased the yields and 1000 kernel weight for each seed dressing.

CONCLUSIONS: Treating Harrington with BAYTAN 30 provided early foliar disease protection for the first 4 weeks after seeding. The spraying of TILT at 6 weeks reduced leaf disease infection, particularly scald, within 2 weeks of application and increased yields and 1000 kernel weights.

Table 1. The effect of TILT and seed dressings on foliar disease development in Harrington barley – Lacombe 1997.

		Emer-	4 wk	June 30		July 10		July 24		Aug 8			1000
Foliar Fung.	Seed Dressing	gence #/m	Les. #/m*	Scor 0-9	Dis **	Score 0-9	Dis	Score 0-9	Dis	Score 0-9	Dis	Yield kg/ha	kernel g
TILT	BAYTAN	45	8	2	3	2	3	3	3	4	3	5435	42.8
TILT	BAYTAN	46	4	3	4	2	4	3	4	4	4	4540	42.1
TILT	VITAFLOW	48	22	3	2	3	3	4	3	4	3	4269	41.2
TILT	RAXIL	52	33	3	2	3	3	4	3	4	3	4623	42.0
TILT	Untreated	51	35	3	3	3	3	3	3	4	3	5163	42.0
No	BAYTAN	49	15	3	3	4	2	6	2	6	3	4360	39.2
No	BAYTAN	42	4	3	3	3	3	4	3	6	3	3678	39.2
No	VITAFLOW	48	26	3	2	4	1	6	2	7	2	3960	39.2
No	RAXIL	45	20	3	3	4	2	5	2	6	2	4194	39.4
No	Untreated	55	35	3	3	4	1	6	2	6	2	3425	38.0
	LSD $_{.05}$	ns	13.9	ns		0.7		0.9		1.1		929	2.2

* Number of leaves with lesions counted 4 weeks after seeding.

** Dis = foliar disease present where 1=scald, 2=mainly scald/some net, 3=mainly net/some scald, 4=net. Data was not analyzed.

PRM REPORT # 106 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Winter barley (*Hordeum vulgare* L.), cv. several
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: **SUSCEPTIBILITY OF WINTER BARLEY BREEDING LINES TO FUSARIUM HEAD BLIGHT IN ARTIFICIALLY INOCULATED, MISTED PLOTS**

METHODS: The crop was planted on 12 October, 1996 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 17.8 cm and 4 m in length placed in a randomized block design with four replications. The plots were fertilized and maintained using provincial recommendations. Inoculations were timed according to anthesis heading for each plot, and were done at 50% anthesis of primary heads. The plots were inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 50,000 spores/ml produced in liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute for 2 hr after 16:00 hr. The misters delivered about 7.5 mm of water each day. The entire mist system was engaged until three days after the last inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot. Heads were placed into one of seven classes 0,5,15,30,50,75,100 % infected spikelets. A fusarium head blight index (FHBI) was applied to the data, which was the product of the percent heads infected and the percent spikelets infected. The plots were harvested on 30 July and the yields were corrected to 14% moisture. Sixty randomly-selected seeds were surface-sterilized in 3% NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and percent Fusarium infected kernels was determined. Deoxynivalenol (DON) content was estimated for the three most highly infected replications using a quantitative ELIZA test. Percentage data were transformed to SQR (arcsin %). Reported means are untransformed.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: The analysis of variance of the percent spikelets infected, percent seeds infected, and FHB index shows that there was no significant difference between cultivars. According to percent heads infected OAC ELMIRA was the most susceptible line, and H120-07 was the most resistant one to fusarium head blight. MCGREGOR had significantly higher DON content than some of the other lines tested.

Table 1. Susceptibility of breeding lines of winter barley to Fusarium head blight in artificially inoculated and misted plots. Ridgetown, Ontario, in 1997.

Winter barley line	Percent spikelets infected	heads infected	Percent FHB index (PSI x PHI)	DON (ppm)	Percent seeds infected**
1 OAC ELMIRA	21	95	20	5.8	33.6
2 MCGREGOR	28	85	24	9.4	45.7
3 MACDIARMID (H30-11)	17	78	14	5.1	53.7
4 H054-28	22	83	19	4.8	56.7
5 HO88-03	21	90	20	2.1	45.7
6 H092-01	20	93	18	2.5	62.7
7 H113-02	17	68	13	3.4	34.7
8 H117-01	25	78	22	5.0	57.0
9 H117-17	17	85	15	4.6	51.7
10 H120-07	14	58	12	2.4	47.3
11 H120-15	15	75	11	2.6	47.7
12 H120-18	23	85	21	4.3	49.7
13 H122-01	21	80	18	4.4	63.0
14 H122-15	15	63	11	3.8	41.0
15 H126-28	30	83	27	3.0	50.7
16 H58-04	17	70	12	2.5	56.0
17 HHYB322	11	80	10	2.0	44.0
LSD (P=.05)	18.3	27.1	18.1	5.2	28.1
CV	65.25	23.94	74.90	77.86	34.07

PMR REPORT # 107 **SECTION K:** **CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Canola, *Brassica rapa* L., cv. Goldrush
PEST: Sclerotinia stem rot, *Sclerotinia sclerotiorum* (Lib.) De Bary

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TITLE: FOLIAR FUNGICIDE APPLICATION FOR CONTROL OF SCLEROTINIA IN CANOLA

MATERIALS: ICIA 5504 (250 g/l azoxystrobin FL), ROVRAL FLO (250 g/l iprodione FL)

METHODS: The trial was conducted at Minto, MB. The polish canola, Goldrush variety, was seeded at 7 kg/ha on May 28, with a double disc press drill. Nitrogen (80 kg/ha) and P2O5 (20 kg/ha) were banded at seeding. The experimental design was randomized complete block design with four replications. Plots (2 m wide by 7.5 m in length) were separated by a 2 m untreated check strip. Weeds were controlled with clethodim, clopyralid and ethametsulfuron-methyl (at 0.05 kg ai/ha, 0.100 kg ai/ha and 0.020 kg ai/ha, respectively). The fungicides treatments (ICIA 5504 at 175 and 250 g ai/ha, ROVRAL FLO) were applied at 10-25% petal drop stage (HB 4.2) using a back-pack sprayer equipped with flat-fan nozzles (Lurmark 80015) delivering 100 l/ha of water at 275 kPa. *Sclerotinia* sp. inoculum (mycelium + agar blended together and filtered through cheese cloth) was sprayed at 50% flowering. Crop tolerance ratings were made using % rating scale (0 = no effect; 100 = dead plant). Incidence and severity of the sclerotinia disease was recorded at 26 DAA (days after application). More than fifty canola plants per plot were assessed for stem infection and rated on 1-5 scale with 1 and 5 being the healthy and severe categories, respectively (see Pesticide Research Report, 1982, p. 238). By assigning numerical values (NV) of 0, 1.25, 2.5, 3.75 and 5, respectively, to categories 1 to 5, the overall disease intensity expressed as "percent disease rating" was computed using the following equation: DR (%)= (no. plants in category * NV)*100 / total no. of plants *5.

RESULTS: See table below.

CONCLUSIONS: Goldrush canola demonstrated excellent tolerance to all fungicide treatments. No injury was observed at 14 DAA. The disease development was good and uniform throughout the plots. All fungicides significantly reduced severity of sclerotinia disease as compared to the untreated check (see disease ratings). However, there was no significant difference in disease ratings between treated plots. Although no treatment resulted in a significantly higher yield, all fungicide treatments resulted in increased yields of 14 to 29%. There was no significant difference in performance between the two rates, 175 g ai/ha and 250 g ai/ha, of ICIA 5504.

Table 1. Effects of ICIA 5504 on Sclerotinia Stem Rot control in canola.

	Treatment	Rate	Crop Tolerance	Disease Rating	Yield
		kg ai/ha	%	%	kg/ha
1	Untreated check	-	0.0 a*	26.3 a	936 a
2	ICIA 5504	175	0.0 a	12.5 b	1068 a
3	ICIA 5504	250	0.0 a	9.5 b	1084 a
4	ROVRAL FLO	500	0.0 a	10.8 b	1214 a

* Means followed by the same letter do not significantly differ at the 5% level according to Duncan's Multiple Range Test

PMR REPORT # 108 SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS

ICAR: 306001

CROP: Canola (*Brassica napus* L.) cv. OAC Summit
PEST: Blackleg, *Leptosphaeria maculans* (Desm.) Ces. et de Not.

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TITLE: EVALUATION OF SEED TREATMENTS TO CONTROL BLACKLEG OF CANOLA

MATERIALS: VITAVAX RS (carbathiin 45 g/L, thiram 90 g/L and lindane (gamma BHC) 680 g/L) @ 22.5 mL/kg seed; UBI 2728 (carbathiin, thiabendazole, lindane, and metalaxyl, rates confidential) @ 15 mL/kg seed; UBI 2732 (carbathiin, thiabendazole, and metalaxyl, rates confidential) @ 12 mL/kg seed.

METHODS: Canola seed was surface sterilized in 0.6% sodium hypochlorite for 3 minutes, then rinsed thoroughly in distilled water. Surface sterilized seed was infested with a highly virulent isolate of *L. maculans* at a rate of 4 g seed/10 mL spore suspension (10^7 conidia/mL). Seed was soaked in the spore suspension for 18 hours. Infested seed was dried in a fumehood for 24 hours. The test products were added to infested seed in an Erlenmeyer flask and shaken for approximately 5 minutes to ensure thorough coating. Flasks were primed prior to treating seed by treating a batch of seed which was discarded prior to treating seed for experimental use. Three controls were used: seed that was surface sterilized then infested with *L.maculans* but not treated with fungicide, uninfested surface sterilized seed that was soaked for 18 hours in sterile distilled water, and uninfested untreated seed that was neither surface sterilized nor soaked. Four replicate 15-cm-diameter pots per treatment were filled with fine vermiculite and each was sown with 15 seeds at a depth of 2.5 cm. Pots were placed on 15-cm-diameter aluminum pans and covered with plastic bags for 4 days to maintain high humidity and induce germination. Plants were grown at 25/20°C under a 16/8 h light/dark regime. They received water daily between emergence and the appearance of the first true leaves, and fertilizer solution (28-14-14; 31 g/25 L distilled water) thereafter. Emergence was recorded 14 days after seeding. Twenty-eight days after seeding, plants were rated as diseased if the leaves showed chlorosis or necrosis, or if the plant was dead. The experiment was repeated in two trials.

RESULTS: The results are shown in Table 1. The emergence of canola seedlings was statistically equal for all treatments in both trials with the exception that emergence from uninfested control seed soaked for 18 hours in water was significantly lower than in other treatments in trial 1. The proportions of diseased plants produced from seed treated with VITAVAX RS or UBI 2732 were not significantly different from each other or from those in uninfested control treatments. The proportion of diseased plants produced from seed treated with UBI 2728 in trial 2 was not different from that of seed treated with UBI 2732 or VITAVAX RS and of untreated uninfested seed. However, in trial 1 a significantly greater proportion of diseased plants was produced from seed treated with UBI 2728 compared to seed treated with the other two test products or the uninfested controls. In both trials, untreated infested seed produced a significantly greater proportion of diseased plants than untreated uninfested seed, or infested seed treated with any of the three test products.

CONCLUSIONS: Emergence from treated seed was equivalent to that from untreated unifested seed. Therefore, the chemicals were not phytotoxic. UBI 2732 was as effective a seed treatment against *L. maculans* as VITAVAX RS and both produced a significantly lower proportion of diseased plants than the infested untreated control. UBI 2728 was as effective as VITAVAX RS in trial 2, and while slightly less effective in trial 1, still produced a significantly lower proportion of diseased plants than the infested untreated control in both trials.

Table 1. Effects of VITAVAX RS, UBI 2728 and UBI 2732 applied to canola seed infested with *L. maculans* on emergence and proportion of diseased plants.

	Emergence*		Proportion diseased**	
Treatment	Trial 1	Trial 2	Trial 1	Trial 2
VITAVAX RS	14.50 a***	14.25 a	0.04 c	0.16 b
UBI 2728	15.00 a	13.50 a	0.23 b	0.18 b
UBI 2732	15.00 a	14.75 a	0.00 c	0.19 b
Infested control	15.00 a	14.50 a	0.98 a	0.92 a
Uninfested control	14.75 a	14.25 a	0.18 c	0.05 b
Uninfested control soaked 18 h	10.50 b	13.00 a	0.03 c	0.04 b

* Values are the mean number of plants per pot 14 days after seeding at the rate of 15 seeds per pot.

** Values are the mean number of diseased plants 28 days after seeding as a proportion of the number of emerged plants.

*** Within a column, means followed by the same letter are not significantly different at P=0.05 (LSD test).

PMR REPORT # 109 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE NUMBER: 375-1411-8719

CROP: Canola, *Brassica rapa*, cultivar AC Boreal
PEST: Alternaria black spot, *Alternaria* spp.

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TITLE: **EFFECT OF FUNGICIDE APPLICATION ON ALTERNARIA BLACK SPOT IN AC BOREAL CANOLA, 1997.**

MATERIALS: BRAVO 500 (chlorothalonil 500g/L), IB11522 (chlorothalonil 500g/L), TILT (propiconazole 250g/L), ROVRAL FLO (iprodione 250g/L), ICIA5504 (azoxystrobin 800g/kg).

METHODS: A randomized complete block test with four replicates was established in a commercially grown field of AC Boreal canola, at Medstead, Saskatchewan in 1997. The crop was seeded on May 26 with a press drill with 15 cm row spacings. Naturally occurring inoculum of *Alternaria* spp. was relied upon for infection. The test area was established on June 19 by rotovating a two meter area around each replicate. Plots within the replicates were five meters long by two meters wide. Two rows of crop on either side of the centre seven rows of each plot was removed. This created a walkway for spraying and marked out the area to be harvested. All treatments were sprayed using a hand-held, CO_2 pressurized, four nozzle boom sprayer at 35 psi fitted with Lurmark 01-F80 nozzles. The water volume was 100L/ha for the water control, ROVRAL FLO, ICIA5504, and TILT treatments, and 225L/ha for Bravo and IB11522 treatments. ROVRAL FLO 500gai, ROVRAL FLO 250gai, ICIA5504 250gai and ICIA5504 125gai were sprayed on July 10 when the plants were at 30 to 40% bloom. All other treatments including a water control were sprayed on July 23 at 95% petal drop. Ten main stems from each plot were visually assessed for disease on pods on August 7, when the seed was at the hard rolled to 20% colour change stage. Plots were harvested (7 rows x 5 m long) on August 28 and yield was recorded as kilograms per hectare of dry grain. Subsamples were taken from each plot and the seed was surface disinfested for 10 min with 0.6% sodium hypochlorite and then air dried. This seed was then used to determine percent germination and percent infection by the two *Alternaria* spp. - *A. brassicae* and *A. raphani*. To determine percent germination 200 seeds/plot were vacuum plated (20 seeds/plate) onto 1.8% water agar amended with 100mg/L streptomycin and 50mg/L vancomycin. These plates were incubated at 20• C for 3-5 days, at which time germinated seed was counted and calculated as a percentage of the total seeds plated. Three hundred seeds/plot were plated (20 seeds/plate) on V-8 juice agar amended with 40mg/L rose bengal and 100mg/L streptomycin. After seven days under fluorescent lights (12 hour day/night cycle) at 18-24• C, the plates were examined for presence of the two *Alternaria* spp. The species were differentiated by examining colony morphology, and by determining spore shape and size under a compound microscope. Results were reported as the percentage of total seed infested. Percent green seed was determined by crushing 500 seeds/plot and counting the number of green seeds. Thousand kernel weights were determined by weighing 500 seeds and multiplying by two. Sclerotinia stem rot and blackleg basal stem canker incidence, caused by the pests *Sclerotinia sclerotiorum* and *Leptosphaeria maculans* respectively, were rated on the stubble of 40 plants. Twenty plants were randomly collected on August 28 from the control plots and from ICIA5504(250gai) sprayed at 30-40% bloom. Data was analyzed using an analysis of variance procedure.

RESULTS: See Tables 1 and 2 below. No yield differences occurred between treatments. Disease levels were relatively low, however ROVRAL(250gai) applied at 95% petal drop significantly (P=0.05) reduced the incidence of black spot in the field when compared to the control (Dunnett's test). There were no significant differences in the incidence of blackleg lesions or cankers among treated and untreated plots. The level of *A. brassicae* in seed was reduced, as compared to the control, by treatments of ROVRAL (500gai) and ICIA5504 (250gai &125gai) applied at 95% petal drop. Plots sprayed with Tilt at 95% petal drop and ICIA5504 (125gai) at 30-40% bloom significantly increased the level of *A. raphani.* There were no significant differences in green seed count, germination or thousand kernal weight between treatments.

CONCLUSIONS: Due to low disease levels in the summer of 1997, there were no yield or seed quality differences between fungicide treatments and the control. In the cases of disease incidence and seed infestation, treatments of Rovral and ICIA5504 applied at 95% petal drop outperformed those applied at 30-40% bloom. Disease incidence was reduced by the half rate of ROVRAL applied at 95% petal drop. *A.brassicae* in seed was reduced by both the full and half rate of ICIA5504 and the full rate of Rovral when applied at a 95% petal drop. The 30-40% bloom application of ICIA5504(125gai) increased the levels on *A. raphani* in seed.

Table 1. The effect of foliar applied fungicides on mean percent disease of alternaria black spot on main stem pods, thousand kernal weights and yield of AC Boreal canola.

Product	Rate (/ha)	Application* timing	Alternaria Black Spot(%)	1000 KWT (g)	Yield (kg/ha)
Control	----	2	0.47	1.98	1876
ROVRAL FLO	500gai	1	0.30	1.99	1863
ROVRAL FLO	500gai	2	0.17	1.98	1843
ROVRAL FLO	250gai	1	0.43	1.99	1827
ROVRAL FLO	250gai	2	0.03**	1.94	1777
ICIA5504	250gai	1	0.50	1.99	1885
ICIA5504	250gai	2	0.17	2.03	1900
ICIA5504	125gai	1	0.20	2.02	1916
ICIA5504	125gai	2	0.20	2.07	1768
BRAVO 500	2.47L	2	0.27	1.95	1887
IB11522	1.5L	2	0.37	2.02	1883
IB11522	2.0L	2	0.23	1.96	1942
TILT	250gai	2	0.27	1.96	1834

* 1=30-40% bloom; 2=95% petal drop.

** Values in the same column which are followed by '**' are significantly different than the control at P=0.05 according to Dunnett's Test. All results are based on transformed data.

Table 2. The effect of foliar applied fungicides on mean percent green seed, *A. brassicae* and *A. raphani* infection in seed, and percent germination of AC Boreal canola.

Product	Rate (/ha)	Application timing	Green seed (%)	*A. brassicae* (% infection)	*A. raphani* (% infection)	Germin-ation(%)
Control	----	2	0.8	2.4	0.3	97
ROVRAL FLO	500gai	1	1.5	1.3	0.9	97
ROVRAL FLO	500gai	2	0.7	0.6**	0.4	98
ROVRAL FLO	250gai	1	0.9	2.1	0.7	96
ROVRAL FLO	250gai	2	1.2	1.3	0.5	97
ICIA5504	250gai	1	1.7	1.9	0.1	97
ICIA5504	250gai	2	1.0	0.3**	0.1	98
ICIA5504	125gai	1	1.2	2.4	1.7**	95
ICIA5504	125gai	2	1.5	0.7**	0.8	96
BRAVO 500	2.47L	2	1.2	2.7	0.4	96
IB11522	1.5L	2	1.0	2.5	0.6	97
IB11522	2.0L	2	0.7	1.9	0.9	96
TILT 99	250gai	2	0.7	1.4	1.7**	

* 1=30-40% bloom; 2=95% petal drop.

** Values in the same column which are followed by '**' are significantly different than the control at P=0.05 according to Dunnett's Test. All results are based on transformed data.

PMR REPORT # 110 **SECTION K:CEREALS, FORAGE CROPS AND OILSEEDS**

STUDY DATA BASE NUMBER: 375-1411-8719

CROP: Canola, *Brassica rapa*, cultivars Fairview and AC Boreal

PEST: Alternaria black spot, *Alternaria* spp.

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TITLE: EFFECT OF FUNGICIDE APPLICATION ON ALTERNARIA BLACK SPOT IN POLISH CANOLA, 1997.

MATERIALS: ICIA5504 (azoxystrobin 250g/L).

METHODS: Two test sites were established in 1997, in commercially grown fields, on AC Boreal canola at Canwood, SK, and on Fairview canola at Kandahar, SK. Naturally occurring inoculum of *Alternaria* spp. was relied upon for infection. Each test was designed as a randomized complete block with four replicates. The test plots were established by rotovating a two meter area around each replicate. Plots were five meters long by two meters wide, with a one and one half meter guard area on either side of each plot. As both sites were air seeded, a one meter area at the centre of each plot was delineated by hoeing out an area 15 cm wide on either side. This created a pathway for spraying to avoid crop damage and to define the area of the plot to be harvested. All treatments were sprayed using a hand-held, CO_2 pressurized, four nozzle boom sprayer, fitted with Lurmark 01-F80 nozzles, at 35 psi. The water volume was 100L/ha. The Canwood site was seeded on May 28 and the plots were set up June 27. All treatments were sprayed on July 21 at 95% petal drop. Percent disease was visually assessed on main stem pods of 10 randomly selected plants in each plot on August 5 when seeds in lower pods were green in colour and at the hard rolled stage. Harvest was done August 26 with yield recorded as kilograms per hectare of dry grain. The Kandahar site was seeded May 27 and the plots were set up June 23. Spraying occurred July 14 at 95% petal drop. Ten main stems from each plot were rated for disease on pods on July 28 when the seed was at the green medium to hard rolled stage. Plots were harvested August 19. Seed subsamples were taken from each plot and were surface disinfested for 10 min in 0.6% sodium hypochlorite, then air dried. This seed was used to determine the percent germination and the percent infection by the different *Alternaria* spp. Two hundred seeds (20 seeds/plate) were vacuum plated onto 1.8% water agar containing 100mg/L streptomycin and 50mg/L vancomycin. These plates were incubated for 3-5 days at 20• C, then germinated seeds were counted and percent germination determined. Three hundred seeds (20 seeds/plate) were vacuum plated onto V-8 juice agar containing 50mg/L rose bengal and 100mg/L streptomycin. The plates were incubated under fluorescent lights (12 hour day/night cycle) at 20• C for 7 days. *A. brassicae*, *A. raphani* and *Leptosphaeria maculans* colonies were differentiated by examining colony morphology, and by determining spore shape and size under a compound microscope. Results were reported as percent of total seed infested. Percentage green seed was determined by crushing 500 seeds/plot and counting the number of green seeds. Thousand kernel weights were determined by weighing 500 seeds and multiplying by two. Sclerotinia stem rot and blackleg basal stem canker, caused by the pests *Sclerotinia sclerotiorum* and *L. maculans* respectively, were rated on the stubble of 20 plants. Twenty plants were randomly collected at harvest from the control and ICIA5504 (250 gai/ha) plots.

RESULTS: See Table 1 below. Dry conditions at both locations led to extremely low disease levels. Fungicide treatments had no significant effect on yields, disease incidence, seed infestation, or seed quality at Kandahar. At Canwood, ICIA5504 applied at 250gai, reduced disease incidence in the field. With respect to seed infestation, *A. brassicae* and *L. maculans* were reduced significantly in seed harvested from the treated plots. The level of *L. maculans* for the control, 125gai, and 250gai treatments were 0.15, 0.0 and 0.0% infection, respectively. Green seed count, thousand kernal weight and germination were not affected by fungicide treatments. At Kandahar, basal stem cankers and stem lesions of blackleg were found on an average of 33% and 38% of plants respectively. No stem cankers of blackleg occurred at Canwood and stem lesions were found on an average of 12% of the plants.

CONCLUSIONS: Applying ICIA5504 at either full or half rates when disease levels are low had no effect on yield. Disease levels were lowest at Kandahar where the fungicide treatments had no effect on disease incidence or seed quality. The Canwood site exhibited small reductions in black spot disease incidence and *A. brassicae* and *L. maculans* seed infestation when plants were sprayed with either fungicide treatment. Therefore when disease levels are low, the fungicide ICIA5504 has no effect on yield but controls low levels of *A. brassicae* and *L. maculans* in seed

Table 1. The effect of foliar applied fungicides on mean percent disease of alternaria black spot on main stem pods, seed quality, and yield of canola in Canwood.

Product	Rate (/ha)	Alternaria Blk. Spot(%)**	Yield (kg/ha)	*A. brassicae* (% in seed)**	Green Seed(%)**	1000KWT (g)**	Germination (%)
Control	----	0.2	1327	1.9	1.0	2.2	97
ICIA5504	125gai	0.1	1053	0.6*	0.9	2.2	97
ICIA5504	250gai	0.0*	1338	0.2*	0.7	2.3	95

* Values in the same column which are followed by '*' are significantly different than the control at P=0.05 according to Dunnett's Test.

** Results of Dunnett's Test are based on transformed data log10(x+1).

ACKNOWLEDGEMENT: The authors wish to thank Mr. Sheldon Rude and Mr. Jim Vopne for their generous support of this research project.

PMR REPORT # 111 **SECTION K: CEREAL, FORAGE, AND OILSEED CROPS**

CROP: Soybeans
cv. Maple Glen (2575 CHU), RCAT Columbus (3200 CHU), RCAT 9508 (3400 CHU)

PEST: Phomopsis seed mold, *Diaporthe phaseolorum var. sojae (Phomopsis sojae)*

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TITLE: FUNGICIDE SEED TREATMENTS AND PHOMOPSIS SEED MOLD IN SOYBEANS

MATERIALS: VITAFLO 280 (carbathiin 167 g ai/L + thiram 148 g ai/L), UBI 2092-1 (carbathiin 282 g ai/L), UBI 2379-1 (metalaxyl 317 g ai/L), UBI 2643 (thiabendazole 333 g ai/L), UBI 2722-1 (BAYTAN 1%/Wt.).

METHODS: The Maple Glen seed lot was bin run and visibly molded (4 %) with phompsis seed mold. The other two seed lots were obtained from inspected breeders plots and were of high quality. Seed was treated on 12 May 1997 in individual plastic bags and rolled until thoroughly covered in 500g lots. The crop was planted on 24 May 1997 at Ridgetown, Ontario, using a cone seeder at 100 seeds per row. Plots were four rows planted at a row spacing of 43 cm and 5 m in length, in a randomized complete block design with four replications. UBI 2722-1 was applied as a granular material in the seed furrow with the seed. The plots were maintained according to provincial recommendations. Emergence for 1 m of row was counted on June 12 at the first true leaf stage. Average seedling vigour was estimated visually, using a scale of 0-4 where 0=no emergence, 1=cotyledons just visible, 2=cotyledons fully emerged but hooked, 3=cotyledons fully expanded and exposed and first true leaf visible, 4=first true leaf fully expanded. Plant vigour was estimated on 16 June using a scale of 1-10 where 10 was the most advanced seedling, each class was a increment of 10 percent less development of the most advanced seedling. Yield was taken on 23 October 1997 from 3 rows by 5 m per plot and corrected to 14 % moisture.

RESULTS: Seed treatments did not affect emergence, nor were there any differences amongst cultivars in emergence (Table 1). Significant reduction in seedling vigour was noted when UBI 2722-1 was used in furrow as a granular (Table 2). Emergence and plant vigour for the three seed lots were similar (Table 3), however seedling vigour of RCAT Columbus was slightly higher than that of the other two seed lots. A significant interaction between seed lot and seed treatments was observed when yields were measured. (Table 1). The interaction could be explained entirely within the *Phomopsis*-infected seed lot when UBI 2722-1 granular was used in furrow at planting at the higher rate.

CONCLUSIONS:. UBI 2722-1 improved crop yield by 75% in the presence of phomopsis seed mold. Phomopsis seed mold appeared to affect soybean development outside of emergence and early plant development. A similar response was not noted in the absence of phomopsis seed mold.

Table 1. Analysis of variance tables for factorial effects of seed treatment (A) and seed lot/variety (B) on emergence, vigour, and yield of soybeans. Ridgetown, Ont. 1997.

Emergence (seedlings/3 m row)

SOURCE	DF	F	Prob(F)
A	7	0.987	0.4671
B	2	3.499	0.0984
AB	14	1.374	0.2084

Vigour at emergence (1-4 scale)

SOURCE	DF	F	Prob(F)
A	7	3.537	0.0115
B	2	6.391	0.0326
AB	14	0.429	0.9560

Vigour at third leaf stage (1-10 scale)

SOURCE	DF	F	Prob(F)
A	7	1.131	0.3817
B	2	1.344	0.3293
AB	14	0.783	0.6807

Seed yield (T/ha)

SOURCE	DF	F	Prob(F)
A	7	10.43	0.0001
B	2	803.8	0.0001
AB	14	7.66	0.0001

Table 2. Main effect of seed treatment (A) on emergence, vigour and yield of three seed lots of soybeans. Ridgetown, Ont. 1997.

	Treatment	Rate (mL/kg)	Emerge No./3 m row	Vigour seedling 1-4	Vigour Plant 1-10	Yield T/ha
1	CONTROL		36.9	3.6	7.7	2.787
2	Vitaflo 280	2.60	38.6	3.8	7.7	2.774
3	UBI 2092-1 UBI 2379-1 UBI 2643	1.95 .063 0.105	39.9	3.6	7.9	2.919
4	Vitaflo 280 UBI 2379-1	2.60 .063	34.3	3.4	7.5	2.884
5	Vitaflo 280 UBI 2722-1	2.60 0.14*	37.6	3.3	7.3	2.541
6	Vitaflo 280 UBI 2722-1	2.60 0.28*	38.5	3.2	6.8	3.179
7	ANCHOR	6.00	36.9	3.3	7.4	2.788
8	UBI 2379-1 ANCHOR	.063 6.00	37.1	3.7	7.9	2.605
LSD			4.9	0.3	1.1	0.179

*applied as an in furrow granular with the seed (g/m row)

Table 3. Main effect of variety/seed lot (B) on emergence, vigour and yield of three seed lots of soybeans. Ridgetown, Ont. 1997.

	Variety/seed lot	Emerge No./3 m row	Vigour seedling 1-4	Vigour Plant 1-10	Yield T/ha
1	Phomopsis infected*	34.6	3.4	7.4	2.147
2	RCAT COLUMBUS 3200	39.4	3.8	7.7	3.046
3	RCAT 9508 3400	38.4	3.3	7.3	3.236
LSD		4.7	0.3	0.6	0.071

Table 4. Interaction of seed treatment and variety/seed lot (AB) on emergence, vigour and yield of three seed lots of soybeans. Ridgetown, Ont. 1997.

Seed Treatment*	Method**	Emerge No./3 m row	Vigour seedling 1-4	Vigour Plant 1-10	Yield T/ha
PHOMOPSIS-INFECTED SEED LOT (Maple Glen 2575 CHU)					
1 Untreated		31.5	3.8	7.3	1.859
2 VITAFLO 280	ST	39.5	3.8	8.1	1.860
3 UBI 2092-1,UBI 2379-1,UBI 2643	ST	35.8	3.5	7.8	2.134
4 VITAFLO 280,UBI 2379-1	ST	33.3	3.5	7.9	2.083
5 VITAFLO 280,UBI 2722-1 (1x)	ST, IF	35.8	3.3	7.0	2.109
6 VITAFLO 280,UBI 2722-1 (2x)	ST, IF	39.5	3.3	6.5	3.301
7 ANCHOR	ST	30.0	3.0	6.5	1.915
8 ANCHOR,UBI 2379-1	ST	31.8	3.5	8.0	1.912
VARIETY RCAT COLUMBUS 3200 CHU					
1 Untreated		45.0	3.8	7.9	3.209
2 VITAFLO 280	ST	39.5	4.0	8.0	3.175
3 UBI 2092-1,UBI 2379-1,UBI 2643	ST	40.8	4.0	8.0	3.313
4 VITAFLO 280,UBI 2379-1	ST	33.8	3.8	6.9	3.229
5 VITAFLO 280,UBI 2722-1 (1x)	ST, IF	34.3	3.8	8.1	2.234
6 VITAFLO 280,UBI 2722-1 (2x)	ST, IF	38.5	3.3	6.9	3.154
7 ANCHOR	ST	42.8	3.8	7.5	3.152
8 ANCHOR,UBI 2379-1	ST	40.5	3.8	8.1	2.903
VARIETY RCAT 9508 3400 CHU					
1 Untreated		34.3	3.3	8.0	3.292
2 VITAFLO 280	ST	36.8	3.5	6.9	3.286
3 UBI 2092-1,UBI 2379-1,UBI 2643	ST	43.3	3.3	7.9	3.311
4 VITAFLO 280,UBI 2379-1	ST	36.0	3.0	7.6	3.341
5 VITAFLO 280,UBI 2722-1 (1x)	ST, IF	42.8	3.0	6.9	3.280
6 VITAFLO 280,UBI 2722-1 (2x)	ST, IF	37.5	3.0	6.9	3.081
7 ANCHOR	ST	38.0	3.3	7.1	3.296
8 ANCHOR,UBI 2379-1	ST	39.0	3.8	7.3	2.999
CV		17.2	15.2	15.3	8.32
LSD		9.4	0.8	1.6	0.37

* see Table 2 for rates of application (1x)=lower rate of UBI 2722-1 and (2x)=higher rate

** ST = seed treatment, IF = in furrow granular with the seed

PMR REPORT # 112 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE: 303-1212-8907

CROP: Wheat, AC Barrie
PEST: Septoria leaf blotch, *Septoria nodorum*
Fusarium head blight, *Fusarium graminearum*

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TITLE: INFLUENCE OF FUNGICIDE SEED TREATMENTS ON DISEASE AND YIELD IN WHEAT, 1997

MATERIALS: VITAFLO 280 (UBI2051-1, carbathiin 14.9%, thiram 13.2%), UBI2383-1 (BAYTAN 30, triadimenol 317 g/L), UBI2584-3 (RAXIL, 8.33 g/L), UBI2092-1 (VITAFLO 250, carbathiin 282 g/L), UBI2643 (TBZ, 333 g/L), UBI2379-1 (metalaxyl, 317 g/L), UBI2770 (carbathiin, 16.7%, thiabendazole, 1.5%, imazalil 1.2%), DIVIDEND 360F (difenconazole, 360 g/L), APRON XL (metalaxyl-m, 330 g/L), DIVIDEND XL RTA(difenconazole, 7.5 g/L, metalaxyl-m, 3.15 g/L), DIVIDEND XL (difenconazole, 183 g/L, metalaxyl-m, 15 g/L), PROSEED (hexaconazole, 5 g/L).

METHODS: Wheat seed, cv. AC Barrie, a powdery mildew susceptible cultivar, was treated with the fungicides listed above at the rates listed in the table, in a small batch seed treater. Wheat plots were established on May 28, 1997, at a seeding rate of 400 viable seeds per m^2. Each plot was ten rows wide and five metres long, 17.8 cm between rows. Treatments were replicated four times in a randomized complete block design, Each wheat plot was separated by an equal sized barley plot. Plots received a herbicide application of MCPA (1L/ha) plus REFINE EXTRA (20g/ha).

At Zadok's Growth Stage (ZGS) 80 septoria leaf blotch was assessed on the penultimate leaf of 10 randomly selected tillers per plot using the Horsfall & Barratt Rating System. Fusarium head blight was rated on a 0 - 9 scale where ten randomly selected heads per plot were rated as to symptom severity where 0 was disease free and 9 represented the entire head being infected. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: There was no effect of seed treatment on emergence. Results of seed treatment effects on disease severity and yield are presented in Table 1.

CONCLUSIONS: Conditions in 1997 were not conducive to the development of powdery mildew and none was present. The environmental conditions were such that they did not result in severe septoria leaf blotch or fusarium head blight. The overall result was no effect on yield components.

Table 1. Efficacy of fungicide seed treatments in wheat, Charlottetown, PEI, 1997.

Treatment	Rate ml product/kg seed	Septoria leaf blotch (%) 2nd leaf, ZGS 80	Fusarium head blight (0-9)	Yield (kg/ha)	1000 kernel (g)
Untreated Control		19.5	2.34	3488	35.35
Vitaflo 280	2.30	20.1	2.28	3496	35.30
Vitaflo 280	3.30	20.8	2.34	3743	35.40
UBI2092-1	1.95	19.5	2.99	3459	35.79
UBI2092-1 + UBI2643 + UBI2379-1	1.95 + 0.105 + 0.063	20.7	2.17	3393	34.85
UBI2643	0.105	14.8	2.81	3180	34.80
UBI2379-1	0.063	17.4	2.84	3305	34.40
UBI2770	3.06	20.3	2.28	3541	35.50
UBI2584-3	1.80	25.4	1.52	3533	36.82
UBI2383-1	0.48	25.4	2.52	3740	36.34
DIVIDEND 360FS	0.33	22.9	2.16	3285	34.85
APRON XL	0.03	16.3	2.16	3282	33.75
DIVIDEND XL RT	3.25	24.6	2.52	3322	35.41
DIVIDEND XL	0.65	23.4	2.87	3163	34.30
PROSEED	3.00	21.9	2.87	3400	35.40
PROSEED	4.00	25.8	2.09	3434	35.50
sem*		5.79	0.473	166.0	1.026
LSD (0.05)		NS**	NS	NS	NS

* sem = standard error of mean

** NS = not significant at a 0.05 level of probability

CROP: Hard red spring wheat (*Triticum aestivum*), cv. Roblin
PEST: Septoria leaf spot, *Mycosphaerella graminicola*
Fusarium head blight, *Fusarium graminearum*
Tan spot, *Pyrenophora tritici-repentis*

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TITLE: EFFICACY OF SELECTED FUNGICIDES FOR CONTROL OF LEAF SPOTS AND FUSARIUM HEAD BLIGHT ON HARD RED SPRING WHEAT

MATERIALS: BRAVO WEATHER STIK (chlorothalonil 720 g/L), BRAVO ULTREX (chlorothalonil 90 WG), BRAVO (chlorothalonil 500 g/L), TILT (propiconazole 250 g/L)

METHODS: The trial was conducted at Portage la Prairie, Manitoba. Plots measuring 3m by 6m were arranged in a RCB design and treatments were replicated four times. Wheat was seeded 3 cm deep using a hoedrill with 19 cm row spacings. Ammonium phosphate (11-52-0) at 41 kg/ha was placed with the seed. Naturally infested wheat residues were spread uniformly across the trial prior to crop emergence. Fungicides were mixed with water at the product rates stated below and were applied with a CO_2 propellant backpack sprayer using Teejet 8001 VS nozzles to deliver 200 L/ha at 275 kPa. Timing of treatments was based on Zadoks growth stages. The BRAVO WEATHER STIK treatment was applied on June 10 (Zadoks 37) at 1.170 L/ha, and on June 17 (Zadoks 50) and 24 (Zadoks 59) at 1.753 L/ha. BRAVO ULTREX was applied on June 10 (Zadoks 37) at 1.0 kg/ha, and on June 17 (Zadoks 50) and 24 (Zadoks 59) at 1.57 kg/ha. BRAVO was applied on June 14 (Zadoks 39) at 0.484 L/ha, and on June 20 (Zadoks 55) at 2.5 L/ha. TILT was applied on June 14 (Zadoks 39) at 0.484 L/ha. BRAVO +TILT tankmix treatment was applied on June 16 (Zadoks 41) at 2.5 L/ha + 0.484 L/ha, respectively. All treatments were visually evaluated for percent wheat heads infected by fusarium head blight and percent flag leaf area infected by leaf spots (*M. graminicola*, *P. tritici-repentis*) on August 12. Wheat yield was measured, then the four replications of each treatment were combined and a subsample of each treatment evaluated for percent tombstone kernels.

RESULTS: Results are summarized in Table 1. Due to unfavourable weather conditions, disease levels were low. Incidence of fusarium head blight tended to be highest in the untreated control. Although statistical differences were not evident, application of BRAVO + TILT, BRAVO WEATHER STIK, BRAVO ULTREX and BRAVO (Zadoks 55) tended to result in lower levels of fusarium head blight compared to BRAVO and TILT (Zadoks 39). Percent tombstone kernels were highest in the untreated control, BRAVO (Zadoks 39) and TILT treatments. Percent leaf area infected by leaf spot diseases was significantly higher in the untreated control compared to all other treatments. Significant differences in wheat yield were not evident.

CONCLUSION: Application of BRAVO formulations with or without TILT at Zadoks 41 and later tended to provide the best control of fusarium head blight. BRAVO WEATHER STIK and BRAVO ULTREX were as effective as other BRAVO or TILT treatments evaluated. A significant impact on wheat yield was not observed as a result of fungicide application; possibly as a result of the low disease levels.

Table 1. The effect of selected fungicides on incidence of fusarium headblight and leaf spot diseases, and the subsequent levels of tombstone kernels and yield of hard red spring wheat.

Treatment	Application Timing	Percent leaf area infected	Percent wheat heads infected	Percent tombstone Kernels	Yield [1] (kg/ha)
BRAVO WEATHER STIK	Zadoks 37, 50, 59	2 b	19	6	2645 [2]
BRAVO ULTREX	Zadoks 37, 50, 59	1 b	18	3	2597
BRAVO	Zadoks 39	3 b	25	11	2501
TILT	Zadoks 39	1 b	23	12	2460
BRAVO/TILT	Zadoks 41	1 b	18	9	2675
BRAVO	Zadoks 55	1 b	18	8	2315
Untreated control	-	18 a	33	13	2439
P• 0.05		s	ns[3]		ns
Coefficient of Variation (%)		57	35		14.75

[1] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[2] Mean of two replicates.

[3] ns - not significant.

CROP: Winter wheat, cv. AC Readymade
PEST: Dwarf bunt, *Tilletia controversa* Kühn
Speckled snow mold, *Typhula incarnata* Lasch ex Fr.

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TITLE: EFFECT OF SEED TREATMENTS ON CONTROL OF SOIL-BORNE DWARF BUNT, EMERGENCE AND WINTER SURVIVAL OF WINTER WHEAT, 1996/97

MATERIALS: DIVIDEND 3FS (difenconazole 360 g/L), BAYTAN (triadimenol 60 g/L), GUSTAFSON LSP (thiabendazole 317 g/L), ACM941 (fungal biocontrol agent of undisclosed species from AAFC, Morden), Acetic Acid.

METHODS: All treatments were applied by the manufacturers, except the acetic acid treatment, which was applied at the Pacific Agri-Food Research Centre by Dr. P. Sholberg, and ACM941, which was applied by Gustafson. Plots were seeded using a one-row cone seeder on Oct. 1, 1996 at Armstrong BC in soil naturally infested with dwarf bunt. The trial consisted of 9 treatments, replicated four times in a randomized complete block design. Each plot consisted of 2 rows, 6 m long, and 23 cm apart. Each row was seeded with 18 g seed. Plots were separated by a row of untreated winter barley. Emergence was assessed on Oct. 30, 1996 by counting the number of plants emerged along one metre of row. Supplemental inoculum was applied on Oct. 30, 1996. Inoculum was prepared by grinding dwarf bunt infected wheat spikes. The ground wheat spikes were mixed with sand, which was sprinkled by hand over the plot area. Winter survival was assessed on April 29, 1997 by counting the number of plants alive along one metre of row. Five metres of each plot was harvested on August 6, 1997 using a 2-row binder. Percent bunt infection was determined by counting the number of healthy and bunted wheat spikes per plot. The total spike count per plot was also analyzed as a reflection of winter survival.

RESULTS: Mean percent bunt infection, emergence, winter survival ratings and total spikes/plot are summarized in Table 1. There were no significant differences in emergence between treatments. Winter survival was affected by speckled snow mold, identified by the BCMAFF Plant Diagnostic Laboratory as *Typhula incarnata*.

CONCLUSIONS: DIVIDEND provided almost complete suppression of dwarf bunt, and was the only treatment providing a commercially acceptable level of control. Gustafson LSP (thiabendazole) at the high rate also provided significant control compared to the check. All treatments containing thiabendazole, at both the high and low rates improved winter survival and significantly increased the total spike count by controlling speckled snow mold.

Table 1. Percent dwarf bunt infection, emergence counts, winter survival ratings and total spike counts by treatment.

Treatment	Rate (g a.i./kg seed)	% Spikes with Bunt	Emergence (plants/m)	Winter Survival (plants/m)	Total Spikes
Check	-	40.3 b*	42.5 a*	29.5 bc*	586 b*
BAYTAN	0.3	61.3 a	44.5 a	29.3 bc	593 b
BAYTAN + GUSTAFSON LSP	0.3 + 0.99	54.6 ab	48.0 a	69.0 ab	1361 a
BAYTAN + ACM941	0.3 + 0.01	52.1 ab	39.8 a	24.3 c	692 b
ACM941	0.01	41.6 b	32.3 a	21.0 c	596 b
Acetic Acid	0.83	48.6 b	43.8 a	29.0 bc	646 b
GUSTAFSON LSP	0.99	38.6 b	44.8 a	75.5 a	1268 a
GUSTAFSON LSP	2.98	6.9 c	48.0 a	65.5 ab	1239 a
DIVIDEND	0.12	0.4 c	42.8 a	34.3 bc	684 b

* Numbers followed by the same letter are not significantly different according to Tukey's Honestly Significant Difference Test (P=0.05).

PRM REPORT # 115 **SECTION K:** **CEREALS , FORAGE CROPS AND OILSEEDS**

CROP: Winter wheat (*Triticum aestivum* L.), cv. Harus
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: CONTROL OF FUSARIUM HEAD BLIGHT IN WINTER WHEAT WITH FOLICUR AT DIFFERENT TIMINGS OF APPLICATION IN ARTIFICIALLY INOCULATED, MISTED PLOTS .

MATERIALS: FOLICUR 250 EC (250 g ai/L tebuconazole)

METHODS: Winter wheat (Harus) was planted on 4 November, 1996 at Ridgetown using a 2.3-m grain drill. Plots were six rows spaced at 17.8 cm apart and 3.5 m in length placed in a randomized complete block design with four replications. Spray applications were made on 15 June, 1996 when the wheat was at "boot" stage (Zadoks growth stage (GS) 45), or on 22 June, 1996 when the wheat had first anthers (GS 60), or on 27 June, 1996 when the wheat was at mid-flower (GS 65). Each plot was sprayed only once using a back pack precision sprayer with a 2-m boom fitted with 2 flat fan nozzles spaced at 50 cm operated at 240 kPa delivering 240 L/ha. Each plot was inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml two days following treatment of fungicide. The suspension was produced in liquid shake culture using modified Bilay's medium. The inoculum was amended with two drops of Tween 20 per 100 ml of inoculum. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute from 10:00-20:00 hr each day. The misters delivered about 7.5 mm of water each day. The mist system was engaged until three days after inoculation. Harus was assessed for visual symptoms when the early dough stage (GS 83) was reached. Ten heads were selected at random out of each plot. Heads were placed into one of seven classes 0,5,15,30,50,75,100 % infected spikelets. A fusarium head blight index (FHBI) was applied to the data, which was the product of the percent heads infected (Incidence) and the percent spikelets infected (Severity). The plots were harvested on 1 August and the yields were corrected to 14% moisture. Sixty randomly-selected seeds were surface-sterilized in 3% NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and percent *Fusarium* infected kernels was determined. Deoxynivalenol (DON) content was estimated for the three most highly infected replications using a quantitative ELIZA test. Percentage data were transformed to SQR (arcsin %). Reported means are untransformed.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: FOLICUR rates and timing provided similar reductions in FHBI and scab severity by comparsion with the untreated check. DON content was significantly reduced using FOLICUR at 0.6 L/ha and 1.0 L/ha when the wheat was at mid-flowering. Yield tended to be higher when FOLICUR applications were made at the first anthers than mid-flowering or at "boot" stage of wheat.

Table 1: Fusarium head blight control in winter wheat (Harus) with different timing of application of FOLICUR 250 EC at the Ridgetown, Ontario. 1997.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index	Yield T/ha	DON (ppm)	Percent seeds infected *
FOLICUR "boot" stage	0.6L	12	78	9	3.6	4.9	17.8
FOLICUR 1st anthers	0.6L	12	78	9	3.8	3.3	22.2
FOLICUR mid flower	0.6L	12	80	10	3.7	2.3	12.2
FOLICUR "boot" stage	0.8L	12	80	9	3.2	3.8	21.7
FOLICUR 1st anthers	0.8L	11	80	9	3.6	2.9	12.2
FOLICUR mid flower	0.8L	8	68	6	3.5	5.5	16.1
FOLICUR 250 EC "boot stage"	1.0L	10	83	9	3.2	6.5	30.5
FOLICUR 250 EC 1st anthers	1.0L	14	73	11	3.8	3.6	25.6
FOLICUR 250 EC mid flower	1.0L	11	75	8	3.6	2.4	8.3
FOLICUR 250 EC "boot stage"	1.2L	12	80	9	3.7	3.7	21.7
FOLICUR 250 EC 1st anthers	1.2L	11	83	9	3.9	3.1	19.4
FOLICUR 250 EC mid flower	1.2L	16	83	21	3.3	2.6	11.1
Untreated check		34	95	32	2.8	6.7	27.8
LSD (.05)		9	16	8	0.5	3.5	16.3
CV		46.1	13.6	49.0	9.9	53.4	51.0

* Infected with *Fusarium graminearum*

PRM REPORT # 116 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Winter wheat (*Triticum aestivum* L.), cv. Harus
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: EFFECT OF FERTILIZERS AND FOLICUR ON FUSARIUM HEAD BLIGHT IN WINTER WHEAT

MATERIALS: Ammonium nitrate (34% N); Ammonium sulfate (20% N); Urea (46% N); Phosphate (46% P2O5); FOLICUR 250 EC, (250 g ai/L tebuconazole).

METHODS: Winter wheat (Harus) was planted on 4 November, 1996 at Ridgetown using a 2.3-m grain drill. Plots were six rows planted at a row spacing of 17.8 cm and 3.5 m in length placed in a randomized complete block design with four replications. The whole experiment received 13 kg N/ha in 6-24-24 before planting and the spring followed by a topdress of 90 kg N/ha in 34-0-0. Each plot (except control) was fertilized on 31 May, 1996 with nitrogen at 15 kg N/ha or phosphate at 20 kg P2O5/ha. FOLICUR was applied on 22 June, 1996 at 1.0 L/ha when the wheat was at anthesis (Zadoks growth stage (GS) 60 to 69) with a back pack precision sprayer at 240 L/ha of water. Fungicide was used as a protectant and applied 2 days before inoculation. The plots were inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml. The suspension was produced in liquid shake culture using modified Bilay's medium. The inoculum was amended with two drops of Tween 20 per 100-ml of inoculum. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute from 10:00-20:00 hr each day. The misters delivered about 7.5 mm of water each day. The mist system was engaged until three days after the last inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot Heads were placed into one of seven classes 0,5,15,30,50,75,100 % infected spikelets. A fusarium head blight index (FHBI) was applied to the data, which was the product of the percent heads infected (Incidence) and the percent spikelets infected (Severity). The plots were harvested on 1 August and the yields were corrected to 14% moisture. Sixty randomly-selected seeds were surface-sterilized in 3% NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and percent *Fusarium* infected kernels was determined. Deoxynivalenol (DON) content was estimated with three replications using ELIZA test. Percentage data were transformed to SQR (arcsin %). Reported means are untransformed.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: Ammonium nitrate as the fertilizer source appeared to potentiate the effects of FHB in
both visible symptoms and DON accumulation. The best results were obtained when urea, ammonium

sulfate in combination with phosphate and FOLICUR were used. There appeared to be an effect due to N-source, but the whole experiment was treated with ammonium nitrate.

Table 1. Effect of fertilizer and FOLICUR on fusarium head blight control in winter wheat (Harus), Ridgetown, Ontario. 1997.

Treatments	Percent spikelets infected	Percent heads infected	FHB index	Yield T/ha	DON (ppm)	Percent seeds infected *
Ammonium sulfate + FOLICUR	12	80	10	9.6	2.9	13.3
Ammonium sulfate	30	87	28	7.0	3.8	36.1
Ammonium nitrate + FOLICUR	14	80	11	8.7	3.3	28.3
Ammonium nitrate	34	93	32	7.6	3.8	36.1
Urea+FOLICUR	17	73	14	8.9	2.7	9.4
Urea	34	90	34	7.5	3.5	34.4
Phosphate+FOLICUR	13	80	11	8.8	3.5	26.7
Phosphate	20	87	18	7.9	3.8	30.6
Ammonium sulfate+ Phosphate+FOLICUR	10	70	8	9.6	3.5	29.6
Ammonium sulfate+ Phosphate	29	90	26	7.4	3.8	36.1
Ammonium nitrate+ Phosphate+FOLICUR	16	83	15	9.0	7.3	23.9
Ammonium nitrate+ Phosphate	40	93	39	6.7	3.7	28.3
Urea+Phosphate +FOLICUR	11	73	9	9.4	2.5	21.1
Urea+Phosphate	25	90	22	9.2	3.3	18.4
FOLICUR	14	93	13	8.9	3.3	27.8
Untreated check	21	87	19	7.5	3.7	32.2
LSD (P=.05)	18	20	19.0	1.9	3.8	27.5
CV	49.74	14.45	59.24	14.22	63.04	61.12

* Infected with *Fusarium graminearum*

PRM REPORT # 117 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Winter wheat (*Triticum aestivum* L.), cv. Ruby
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: CONTROL OF FUSARIUM HEAD BLIGHT IN WINTER WHEAT BY FOLICUR AND SODIUM BICARBONATE IN ARTIFICIALLY INOCULATED, MISTED PLOTS

MATERIALS: Sodium bicarbonate; FOLICUR 250 EC (250 g ai/L tebuconazole).

METHODS: Winter wheat (Ruby) was planted on 4 November, 1996 at Ridgetown using a 2.3-m grain drill. Plots were six rows planted at a row spacing of 17.8 cm and 3.5 m in length placed in a randomized complete block design,with four replications. FOLICUR and sodium bicarbonate were applied on 17 June, 1996 when the wheat was at anthesis (Zadoks growth stage (GS) 60 to 69) with a back pack precision sprayer at 240 L/ha of water. Each plot was inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml two days following treatment of fungicide and sodium bicarbonate. The suspension was produced in liquid shake culture using modified Bilay's medium. The inoculum was amended with two drops of Tween 20 per 100 ml of inoculum. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute from 10:00-20:00 hr each day. The misters delivered about 7.5 mm of water each day. The mist system was engaged until three days after inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot. Heads were placed into one of seven classes 0,5,15,30,50,75,100 % infected spikelets. A fusarium head blight index (FHBI) was applied to the data, which was the product of the percent heads infected (Incidence) and the percent spikelets infected (Severity). The plots were harvested on 1 August and the yields were corrected to 14% moisture. Sixty randomly-selected seeds were surface-sterilized in 3% NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and percent *Fusarium* infected kernels was determined. Deoxynivalenol (DON) content was estimated in the three replications that had the highest mean FHB index using a quantitative ELIZA test. Percentage data were transformed to SQR (arcsin%). Reported means are untransformed.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: The analysis of variance of the percent spikelets infected, percent heads infected, FHB index, yield and % seeds infected shows that there was no significant difference between treatments.

Table 1. Fusarium head blight control in winter wheat (Ruby) with application of FOLICUR 250 EC and Sodium bicarbonate. Ridgetown, Ontario. 1997.

Treatments	Rate of		Percent	Percent	FHB	Yield	DON
						Percent	
	product/ha	spikelets infected	heads infected	index	T/ha	(ppm) infected*	seeds
FOLICUR	0.5 L	9	73	7	2.9	3.6	15.0
+ Sodium bicarbonate	2.0 kg						
FOLICUR	0.5 L	8	63	5	3.1	3.6	13.4
+ Sodium bicarbonate	3.0 kg						
FOLICUR	0.5 L	14	80	12	2.8	3.3	17.8
FOLICUR	1.0 L	13	83	11	3.4	3.8	21.7
+ Sodium bicarbonate	2.0 kg						
FOLICUR	1.0 L	9	68	6	3.1	3.3	14.4
+ Sodium bicarbonate	3.0 kg						
FOLICUR	1.0 L	9	70	6	3.0	3.4	18.3
Sodium bicarbonate	2.0 kg	19	75	16	3.2	3.6	15.0
Sodium bicarbonate	3.0 kg	20	78	18	3.2	3.3	16.1
Untreated check		23	85	21	2.8	4.5	29.4
LSD (P=.05)		16	20	17	0.6	0.8	19.7
CV		80.43	18.28	101.98	11.46	13.13	63.6

* Infected with *Fusarium graminearum*

PRM REPORT # 118 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Winter wheat (*Triticum aestivum* L.), cv. several
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: CONTROL OF FUSARIUM HEAD BLIGHT IN WINTER WHEAT WITH FUNGICIDES IN ARTIFICIALLY INOCULATED, MISTED PLOTS

MATERIALS: BRAVO 500 WEATHER STIK, (500 g ai/L chlorothalonil); FOLICUR 250 EC (250 g ai/L tebuconazole); ICIA5504 (80WG 80% w/w experimental, azoxystrobin); TILT 250 EC, (250 g ai/L propiconazole)

METHODS: Four varieties of winter wheat (Pioneer 2510, Freedom, Fundulea and Yorkstar) were planted on 4 November, 1996 at Ridgetown using a 2.3-m grain drill. Plots were six rows spaced at 17.8 cm apart and 3.5 m in length placed in a randomized complete block design with four replications. Spray applications were made on 22 June, 1996 when the wheat was at anthesis for each variety (Zadoks growth stage (GS) 60 to 69) using a back pack precision sprayer with a 2-m boom fitted with 2 flat fan nozzles spaced at 50 cm operated at 240 kPa delivering 240 L/ha. Each plot was inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml two days following treatment of fungicide. The suspension was produced in liquid shake culture using modified Bilay's medium. The inoculum was amended with two drops of Tween 20 per 100 ml of inoculum. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute from 10:00-20:00 hr each day. The misters delivered about 7.5 mm of water each day. The mist system was engaged until three days after inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot. Heads were placed into one of seven classes 0,5,15,30,50,75,100 % infected spikelets. A fusarium head blight index (FHBI) was applied to the data, which was the product of the percent heads infected (Incidence) and the percent spikelets infected (Severity). The plots were harvested on 1 August and the yields were corrected to 14% moisture. Sixty randomly-selected seeds were surface-sterilized in 3% NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and percent *Fusarium* infected kernels was determined. Deoxynivalenol (DON) content was estimated for the three most highly infected replications using a quantitative ELIZA test. Percentage data were transformed to SQR (arcsin %). Reported means are untransformed.

RESULTS: Results are given in the tables below.

CONCLUSIONS: There was about 70% reduction of FHBI in Freedom wheat using FOLICUR at 0.8 to 1.0 L/ha. Freedom was the most *Fusarium* resistant cultivar and responded better to protection by fungicides than did the more susceptible cultivars 2510, Fundulea and Yorkstar. ICIA5504 at the rate it was applied provided similar reductions in FHBI by comparison with the best FOLICUR treatments. DON content was not significantly reduced by any treatment for any of the wheat varieties tested with the exception of the highest rate of FOLICUR in Freedom wheat.

Table 1. Fusarium head blight control in winter wheat (PIONEER 2510) with foliar application of fungicides. Ridgetown, Ontario. 1997.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index	Yield T/ha	DON (ppm)	Percent seeds infected
BRAVO WEATHER STIK	2.0 L	19	90	17	6.5	3.3	27.2
BRAVO WEATHER STIK*	1.5 L	18	85	16	6.6	3.2	35.0
BRAVO WEATHER STIK	1.5 L	20	90	18	4.6	3.3	25.5
+ FOLICUR	1.0 L						
ICIA5504	75.0 g	22	80	18	6.3	3.5	48.9
TILT	0.5 L	25	93	23	5.9	3.0	27.2
FOLICUR	0.6 L	17	90	15	6.3	3.3	35.6
FOLICUR	0.8 L	10	83	9	5.7	2.6	23.9
FOLICUR	1.0 L	20	93	18	6.5	3.3	17.8
FOLICUR	1.2 L	16	80	13	6.8	2.8	29.4
Untreated check		35	93	33	6.2	3.0	35.0
LSD (.05)		8	13	7	1.8	0.7	20.9
CV		27.24	9.91	27.82	17.07	13.16	39.97

* two applications of 1.5 L/ha, one at anthesis and second 2 days later.

Table 2. Fusarium head blight control in winter wheat (Freedom) with foliar application of fungicides. Ridgetown, Ontario. 1997.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index	Yield T/ha	DON (ppm)	Percent seeds infected
BRAVO WEATHER STIK	2.0 L	17	93	17	6.4	3.1	28.3
BRAVO WEATHER STIK*	1.5 L	11	80	9	7.0	3.1	18.3
BRAVO WEATHER STIK	1.5 L	13	88	12	7.3	3.3	22.2
+ FOLICUR	1.0 L						
ICIA5504	75.0 g	11	75	9	6.9	3.0	32.8
TILT	0.5 L	13	80	11	6.7	3.2	21.7
FOLICUR	0.6 L	14	80	11	6.9	2.7	18.3
FOLICUR	0.8 L	12	75	9	6.7	2.9	26.1
FOLICUR	1.0 L	10	70	7	7.0	3.2	21.1
FOLICUR	1.2 L	9	75	7	7.4	2.5	13.9
Untreated check		25	90	23	6.6	3.3	31.7
LSD (.05)		8.2	14.1	8.0	1.8	0.7	18.7
CV		41.86	12.05	48.39	14.73	12.35	46.58

* two applications of 1.5 L/ha, one at anthesis and second 2 days later.

Table 3. Fusarium head blight control in winter wheat (Fundulea) with foliar application of fungicides. Ridgetown, Ontario. 1997.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index	Yield T/ha	DON (ppm)	Percent seeds infected
BRAVO WEATHER STIK	2.0 L	12	83	10	3.7	3.1	16.1
BRAVO WEATHER STIK*	1.5 L	13	83	11	3.9	3.2	16.7
BRAVO WEATHER STIK	1.5 L	9	70	7	3.6	2.7	10.6
+ FOLICUR	1.0 L						
ICIA5504	75.0 g	17	83	14	3.9	3.5	17.8
TILT	0.5 L	12	73	9	4.0	3.4	27.2
FOLICUR	0.6 L	10	75	8	3.6	3.1	12.8
FOLICUR	0.8 L	14	83	12	3.7	3.1	20.5
FOLICUR	1.0 L	14	75	10	3.8	2.7	12.8
FOLICUR	1.2 L	13	73	10	3.6	3.0	15.6
Untreated check		27	90	25	3.6	3.1	23.9
LSD (.05)		8	19	8	0.7	0.6	14.1
CV		38.59	16.48	47.97	10.57	11.22	47.16

* two applications of 1.5 L/ha, one at anthesis and second 2 days later.

Table 4. Fusarium head blight control in winter wheat (Yorkstar) with foliar application of fungicides. Ridgetown, Ontario. 1997.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index	Yield T/ha	DON (ppm)	Percent seeds infected
BRAVO WEATHER STIK	2.0 L	20	75	16	3.0	3.7	2.2
BRAVO WEATHER STIK*	1.5 L	20	80	17	3.5	3.5	16.7
BRAVO WEATHER STIK	1.5 L	11	65	7	3.2	6.3	40.0
+ FOLICUR	1.0 L						
ICIA5504	75.0 g	13	70	10	3.2	3.6	17.2
TILT	0.5 L	19	78	15	3.2	3.7	18.3
FOLICUR	0.6 L	9	68	7	2.8	3.8	44.5
FOLICUR	0.8 L	16	75	12	3.2	5.3	28.9
FOLICUR	1.0 L	18	70	14	3.0	3.5	21.7
FOLICUR	1.2 L	15	78	11	3.0	3.4	27.8
Untreated check		25	83	22	3.0	4.4	23.3
LSD (.05)		11.9	15.6	11.7	0.7	3.0	19.4
CV		49.76	14.57	61.51	12.72	42.17	43.47

* two applications of 1.5 L/ha, one at anthesis and second 2 days later.

PRM REPORT # 119 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Winter wheat (*Triticum aestivum* L.), cv. several
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: SUSCEPTIBILITY OF WINTER WHEAT VARIETIES TO FUSARIUM HEAD BLIGHT IN ARTIFICIALLY INOCULATED PLOTS, MISTED PLOTS

METHODS: The crop was planted on 12 October, 1996 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 17.8 cm and 4 m in length placed in a randomized block design with four replications. The plots were fertilized and maintained using provincial recommendations. Inoculations were done at 50% anthesis of primary heads for each plot. The plots were inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml produced in liquid shake culture using modified Bilay's medium. Plots were misted daily beginning on the day the first plots were inoculated. The overhead mister operated at one 8 s burst every minute for 2 hr after 16:00 hr. The misters delivered about 7.5 mm of water each day. The mist system was engaged until three days after the last variety was inoculated. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot. Heads were placed into one of seven classes 0,5,15,30,50,75,100 % infected spikelets. A *Fusarium* head blight index (FHBI) was applied to the data, which was the product of the percent heads infected and the percent spikelets infected. The plots were harvested on 30 July. One hundred randomly-selected seeds were surface-sterilized in 3% NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and percent *Fusarium* infected kernels was determined. Deoxynivalenol (DON) content was estimated with the three replications using a quantitative ELIZA test. Percentage data were transformed to SQR (arcsin%). Reported means are untransformed.

RESULTS: The results are summarized in Table 1. The results fell within the guidelines of the Ontario Cereal Crops Committee of minimum of FHBI of 15%in susceptible checks.

CONCLUSIONS: Most of the tested varieties were susceptible to Fusarium head blight and Deoxynivalenol accumulation in the seeds. Percent incidence and percent spikelets infected were not always related. Sometimes there was a relationship between FHBI, and deoxynivalenol content. Seed infection usually was related to FHBI and DON content (AC READYMADE, FREEDOM, FUNDULEA, ENA, and 25R57). AC READYMADE, CDC CLAIR, and ENA had lowest FHB indices, and also similar DON content. FREEDOM, FUNDULEA, and AC MORLEY were also more resistant to *Fusarium* head blight and DON content than other varieties tested. 25R57 had highest percent incidence, percent spikelets infected, FHB index, percent seeds infected and DON content. Some varieties with higher FHB indices had lower DON content (KARAT/FRONTANA, MENDON) whereas some varieties had lower FHB indices and higher levels of DON (WX12237Z1, DIANA).

Twelve species of Fusarium were recovered from the seed of which *F.graminearum* Schwabe was the most prevalent (87.1 %). The other species that were commonly recovered included: *F. sporotrichioides* Sherb., *F. subglutinans* (Wollenw. & Reinking) Nelson, Toussoun & Marasas, *F. avenaceum* (Fr.) Sacc., *F. poae* (Peck) Wollenw. and *F. crookwellense* Burgess, Nelson & Toussoun. Species less commonly recovered were *F. semitectum* Berk. & Rav., *F. oxysporum* Schlecht. emend Snyd & Hans., *F. moniliforme* Sheldon, *F. culmorum* (W.G. Smith) Sacc., *F. equiseti* (Corda) Sacc. and *F. proliferatum* (Matsushima) Nirenberg. The incidence of *Fusarium* species was not related to wheat variety nor was the incidence of species correlated.

Table 1. *Fusarium* head blight reaction of 66 winter wheat varieties in artificially inoculated and misted plots at Ridgetown, Ontario. 1997.

Winter wheat variety	Percent spikelets infected	Percent heads infected	FHB index (PSI x PHI)	DON (ppm)	Percent seeds infected*
1 PRC 9512	16	65	10	1.6	6.3
2 PRC 9513	18	78	15	1.7	10.0
3 PRC 9516	12	68	10	1.5	8.7
4 PRC 9517	18	75	14	1.9	14.0
5 PRC 9518	12	73	10	1.8	10.0
6 PRC 9520	12	63	7	1.7	9.3
7 PRC 9521	14	65	9	1.9	9.3
8 PRC 9527	23	85	20	1.9	12.7
9 PRC 9529	10	58	6	1.5	10.7
10 PRC 9532	18	73	14	2.1	13.7
11 PRC 9533	15	75	11	1.9	15.7
12 F94010 - S1	17	83	15	2.7	25.7
13 F94011 - M5	15	70	11	2.0	19.3
14 F93012 - M3	33	80	28	4.4	40.3
15 AC CARTER	14	58	8	2.0	14.7
16 AC DEXTER	24	85	21	5.8	26.7
17 AC RON	30	88	28	2.2	13.7
18 AC MORLEY	10	58	7	0.7	7.7
19 HARUS	31	70	22	1.5	7.3
20 AC READY MADE	5	55	3	0.9	7.0
21 FREEDOM	9	63	6	0.9	6.7
22 FUNDALEA	12	63	8	0.7	7.3
23 CM 94090	24	83	20	4.2	41.7
24 TERRA SR213	24	65	16	1.8	14.7
25 PAR 1517	12	75	9	0.9	10.3
26 KARENA	81	58	5	1.9	6.0
27 OAC ARISS	12	60	8	2.1	14.0
28 CASEY	19	78	15	2.0	14.0
29 RUBY	15	75	11	3.1	20.7

30 DIANA	27	80	21	4.6	22.3	
31 MARILEE		15	70	11	1.8	9.7
32 2737 W	29	85	25	6.4	13.7	
33 2510	22	83	20	2.4	20.7	
34 25W33	23	83	20	2.1	13.7	
35 HANOVER	23	83	19	3.9	24.7	
36 MENDON		30	78	26	1.5	22.0
37 OAC 93R:12	12	80	14	1.9	16.3	
38 2540	21	80	18	2.5	18.7	
39 25R57	45	98	44	6.9	55.3	
40 BAVARIA		25	70	18	2.5	12.0
41 TW91203	19	73	14	2.4	27.0	
42 TW93211	14	53	7	1.6	8.0	
43 TW92405	16	63	12	0.8	7.3	
44 CDC CLAIR	5	50	3	1.1	12.7	
45 WB10638E1	17	78	13	2.2	8.3	
46 WX12237Z1	22	78	17	4.6	33.7	
47 25R26	10	63	6	3.4	28.3	
48 ENA	7	53	3	1.1	6.0	
49 OAC 93W:20	23	83	20	2.7	17.0	
50 OAC 93W:14	38	78	30	2.1	19.0	
51 OAC 93W:16S	12	70	8	1.3	9.0	
52 OAC 94W:9P	17	68	13	1.9	10.7	
53 OAC 95W:90S	21	75	16	2.3	16.3	
54 OAC 1 W:8	16	73	13	1.8	12.3	
55 OAC 93W:86P	9	60	6	2.0	13.7	
56 OAC 94W:42P	17	78	13	2.1	14.0	
57 OAC 94W:47P	13	68	9	2.1	8.7	
58 OAC 94W:51P	18	73	13	1.9	15.0	
59 OAC 93R:7	15	73	11	2.0	20.7	
60 OAC 93R:31P	15	83	14	1.9	21.7	
61 OAC 95R:8P	10	60	6	1.3	9.0	
62 OAC 95R:33S	19	65	16	3.4	25.3	
63 OAC 95R:43S	17	75	13	1.9	15.0	
64 KARAT/ FRONTANA	33	83	28	1.5	15.3	
65 RUBY/ FRONTANA SEL1	16	85	14	1.2	13.0	
66 RUBY/ FRONTANA SEL2	12	58	8	1.3	9.0	
LSD (.05)	12	21	12	2.4	14.8	
CV	46.51	20.90	61.83	65.80	57.9	

* Infected with *Fusarium graminearum*

PMR REPORT # 120 **SECTION K: CEREAL, FORAGE, AND OILSEED CROPS**

CROP: Winter wheat cv. AC RON
PEST: Fusarium seedling blight, *Fusarium graminearum* Schwabe

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TITLE: SEED TREATMENTS TO CONTROL FUSARIUM SEEDLING BLIGHT IN WINTER WHEAT

MATERIALS: VITAFLO 280 (UBI 2051-1 carbathiin + thiram, 167 and 148 g a.i./L), UBI 2092-1 (carbathiin 282 g a.i./L), UBI 2643 (thiabendazole 333 g a.i./L), UBI 2379-1 (metalaxyl 317 g a.i./L), UBI 2584-3 (tebuconazole 8.33 g a.i./L)

METHODS: Heavily infected seed (20% *Fusarium* damaged kernels, not removed) was obtained from the 1996 epidemic crop. Seed was treated on 8 October, 1997 in individual plastic bags and rolled until thoroughly covered in 750 g lots. The crop was planted on 11 October, 1996 at Huron Park, Ontario and on 13 October, 1997 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to provincial recommendations. A random sample of non-treated seed (60 seeds) was plated on acidified PDA to determine percent seed infection (55%). Emergence was evaluated on 4 November at Ridgetown and 8 November at Huron Park. Survival notes were taken on 28 April at Ridgetown and Huron Park. Plots were trimmed back to 4 m before harvest. Yields were taken on 31 July at Huron Park and 8 August at Ridgetown and corrected to 14 % moisture.

RESULTS: Results are presented in Table 1 below.

CONCLUSIONS: Carbathiin on its own was ineffective. Emergence and survival was best with carbathiin plus thiram at the higher rate and with carbathiin plus thiabendazole. Metalaxyl did not add any improvements.

Table 1. Emergence, survival and yield of winter wheat where seed was treated with fungicides for the control of Fusarium seedling blight. Ridgetown and Huron Park , Ontario. 1997.

Treatment	(mL/kg seed)	Emergence (Plants/m)		Survival (Tillers/m)		Yield (Tonne/ha)	
		Ridgetn	Huron	Ridgetn	Huron	Ridgetn	Huron
UBI 2051-1	2.3	31.9	30	25.1	38.7	7.697	5.892
UBI 2051-1	3.3	31.1	34.5	26.3	43.3	7.647	6.047
UBI 2092-1	1.95	23.4	27.4	21	32.3	7.716	5.41
UBI 2092-1 UBI 2643	1.95 0.063	31.2	34.5	24.1	46.2	6.987	6.328
UBI 2092-1 UBI 2643	1.95 0.105	34.1	39.1	31.9	43.8	7.66	5.87
UBI 2092-1 UBI 2643 UBI 2379-1	1.95 0.063 0.031	29.5	36.5	17.5	44	6.724	6.183
UBI 2092-1 UBI 2643 UBI 2379-1	1.95 0.105 0.063	33.8	35	23	33.7	6.588	5.893
UBI 2584-3	1.8	35	29.1	32.6	29.2	7.075	5.767
UBI 2643 UBI 2379-1 UBI 2584-3	0.105 0.063 1.8	25.1	32.3	25.75	37.3	7.316	6.009
UBI 2051-1 UBI 2383-1 WATER	2.3 0.95 3.05	24.2	28.1	22.5	37.3	6.678	5.596
CONTROL		24	27.5	22.1	36.3	6.943	5.882
LSD (P=.05)		17.3	11.5	13.3	11.29	1.446	0.6306
CV		20.3	12.4	37.4	20.35	13.9	7.3

PMR REPORT # 121 SECTION K: CEREAL, FORAGE, AND OILSEED CROPS

CROP: Winter wheat cv. Unknown
PEST: Loose smut, *Ustilago tritici*

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TITLE: SEED TREATMENTS TO CONTROL LOOSE SMUT IN WINTER WHEAT

MATERIALS: VITAFLO 280 (UBI 2051-1 carbathiin + thiram, 167 and 148 g a.i./L), UBI 2092-1 (carbathiin 282 g a.i./L), UBI 2643 (thiabendazole 333 g a.i./L), UBI 2379-1 (metalaxyl 317 g a.i./L), EXP80472A 25 FS, VITAVAX 230 FS (carbathiin 230 g a.i./L), CAN0243 (raxil-thiram)

METHODS: Seed was obtained from non-treated, loose smut infected plots from the previous season. Seed was treated on 8 October, 1997 in individual plastic bags and rolled until thoroughly covered with fungicide in 750 g lots. The crop was planted on 13 October, 1997 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to provincial recommendations. Emergence was evaluated on 4 November and survival notes were taken on 28 April. Loose smut was evaluated on June 10 at heading. The number of heads were estimated per plot by counting all the heads in 1m^2. Total infected heads were counted per plot and these were expressed as a percentage of the total heads/plot. Plots were trimmed back to 4 m before harvest. Yields were taken on 8 August and corrected to 14 % moisture.

RESULTS: The expression of loose smut infection was relatively low this year but significant differences between contol and treated plots were obtained. Results are presented in Table 1 below.

CONCLUSIONS: All the materials tested provided excellent control of loose smut with the exception, perhaps of the three-way UBI treatments at the higher rates. This treatment mixture resulted in slight infection at the lower rates and numerically higher infections at the higher rates, but these results were not significant from the other fungicide treatments. None of the treatments resulted in significant increases in yield.

Table 1. Effect of seed treatments on loose smut, crop emergence, and yield of winter wheat. Ridgetown, Ontario. 1997.

Treatment (ml or	Rate g/kg seed)	Emergence (plants/m)	Percent heads infect. Loose Smut	Yield Tonnes/ha
Control		30.3	0.68	4.721
EXP80472A	1.0	36.3	0	5.345
EXP80472A	2.0	41.5	0	5.755
EXP80472A	3.0	43.5	0	5.906
VITAVAX	2.7	44.8	0.01	5.358
RAXIL THIRAM	2.2	46.5	0	5.912
UBI 2051-1	3.3	50.8	0	6.209
UBI 2092-1 UBI 2643 UBI 2379-1	1.95* 0.063 0.031	48.3	0.07	5.388
UBI 2092-1 UBI 2643 UBI 2379-1	1.95* 0.105 0.063	49.3	0.14	5.437
LSD (P=.05)		16.2	0.15	1.355
CV		25.6	102.6	16.7

* The three fungicides in this cluster were applied as a mixture at the same time.

PMR REPORT # 122 **SECTION K: CEREAL, FORAGE, AND OILSEED CROPS**

CROP: Winter wheat cv. Pioneer 2510
PEST: Powdery mildew, *Erysiphe graminis* f. sp. *tritici*
Septoria leaf spot, *Septoria tritici*

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TITLE: SEED TREATMENTS TO CONTROL POWDERY MILDEW IN WINTER WHEAT

MATERIALS: BAYTAN 30 (UBI 2381-1 triadimenol 317 g a.i./L); VITAFLO 280 (UBI 2051-1 carbathiin + thiram, 167 and 148 g a.i./L), BAYTAN 3G, TILT 250 E (propiconazole 250 g a.i./L)

METHODS: Seed was treated on 8 October, 1996 in individual plastic bags and rolled until thoroughly covered in 750 g lots. The crop was planted on 11 October at Huron Park, Ontario and on 13 October, using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to provincial recommendations. The number of plants in 1m (2 rows), emerged was evaluated on 4 November at Ridgetown and 8 November at Huron Park. Survival notes were taken on 28 April at Ridgetown and Huron Park in the same 1m strip (2 rows). Powdery mildew and septoria leaf spot infections were estimated as percentage of the area of each leaf covered with lesions for the same leaf taken from 10 plants at random out of the centre two rows of each plot. Plots were trimmed back to 4 m before harvest. Yields were taken on 31 July at Huron Park and 8 August at Ridgetown and corrected to 14 % moisture.

RESULTS: No significant differences in control of powdery mildew or septoria leaf spot were observed under light pressure at either site. Crop data are presented in Table 1.

CONCLUSIONS: VITAFLO 280 applied as a seed treatment plus the lower rate of BAYTAN 3G applied with the seed resulted in the best emergence and yield of the all the treatments at Ridgetown. However, at Ridgetown, there was no significant advantage to adding BAYTAN 3G by comparison with VITAFLO 280 on its own in final grain yield. No significant effects on emergence or yield whether positive or negative were noted at the Huron Park location.

Table 1. Emergence, survival and yield of winter wheat treated with fungicides for the control of powdery mildew. Ridgetown, Ontario. 1997.

Seed Treatment	ml prod. /kg seed	-----------Ridgetown------------			--------------Huron---------------		
		Emerg. plant/ 2m	Surviv. tillers/ 2m	Yield T/ha	Emerg. plant/ 2m	Surviv. tillers/ 2m	Yield T/ha
VITAFLO 280	3.3	59	68	7.317	64	57	6.086
VITAFLO 280 BAYTAN 30 WATER	3.3 0.95 3.05	46	44	6.627	63	51	5.853
VITAFLO 280 BAYTAN 3 G	3.3 3.6*	68	54	7.751	65	55	5.81
VITAFLO 280 BAYTAN 3 G	3.3 7.2*	48	45	7.031	59	48	5.782
VITAFLO 280 TILT 250 EC	3.3 0.5**	51	50	7.229	49	38	5.654
CONTROL		47	57	6.855	51	39	5.618
LSD (.05)		8.4	19.9	0.847	15.5	20.7	0.591
CV		10.5	25	7.9	17.6	28.7	6.8

* g/100 m row

** l/ha foliar application at Zadoks growth stage 45

PMR REPORT # 123 **SECTION K: CEREALS, FORAGE, AND OILSEED CROPS**

CROP: Wheat (*Triticum aestivum*) cv. Biggar
PEST: Take-all , *Gaeumannomyces graminis* var. *tritici*

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TITLE EFFICACY OF PROSEED SEED TREATMENT FOR CONTROL OF TAKE-ALL DISEASE IN WHEAT

MATERIALS: PROSEED (hexaconazole 5g/L), BAYTAN 30 (triadimenol, 317 g/L)

METHODS: Biggar wheat seed was treated with two rates of PROSEED and one rate of BAYTAN 30. Treatments were applied by placing 750 g of seed in a 6 L erlenmeyer flask and adding the seed treatment. The contents were mixed until the seed was well coated. Two batches for each treatment were prepared and the first batch was discarded. All treatments were inoculated with the Take-all fungus *(Gaeumannomyces graminis* var. *tritici)* grown on oat seed The fungus was grown on Potato Dextrose Agar and this culture was used to inoculate autoclaved oat seeds. The oats were air-dried and ground and 100 g was applied on the surface of each plot immediately before seeding. The seed was planted on May 28, 1997. Emergence counts were made on June 12, 1997. Plots were harvested on September 9, 1997 and the yield in kg/ha was calculated. A sample of 25 plants were sampled from each plot. The number of tillers per plant were counted and each plant was rated for take-all using a 1-5 scale with 1 indicating no disease in the sampled plants and 5 indicating 76-100% of the sampled plants were diseased.

RESULTS: The seedling emergence and the overall disease level appeared to be low. Lack of precipitation during the first 3 weeks of growth could be partly responsible. Compared to the untreated control, all 3 fungicide seed treatments resulted in a reduction in the take-all disease. The higher seed treatment rate of PROSEED (4ml/kg) and BAYTAN 30 (0.5ml/kg) significantly better than the lower rate of PROSEED (3ml/kg). The number of tillers per plant was highest in the untreated control and the lowest in the BAYTAN treatment. Correlation analysis suggested that a significant positive correlation between the level of take-all disease and the number of tillers but no correlation between yield and take-all disease or tillers/plant.

CONCLUSIONS: No significant difference in seedling emergence and yield were observed between treatments. The untreated control treatment resulted in significantly higher infections compared to the treated seed treatments. The BAYTAN 30 and the PROSEED (4ml/kg) treatments resulted in significantly lower plant infections compared to the PROSEED (3ml/kg) treatment. The BAYTAN 30 treatment resulted in fewer tillers compared to the untreated control and the PROSEED (3ml/kg) treatment.

Table 1. Yield, number of tillers per plant, take-all disease level, and 1000 kernel weight for Biggar wheat seed inoculated with take-all fungus and treated with PROSEED and BAYTAN 30.

Treatment	Rate /kg seed	Yield kg/ha	Tillers #/plant	Take-all 1-5*	1000 kernel weight (g)
1. Untreated control	-	1333a**	9.9a	2.3a	26.8a
2. PROSEED	3.0 mls	1101a	9.8a	1.8b	26.5ab
3. PROSEED	4.0 mls	1160a	8.9ab	1.5c	25.1b
4. BAYTAN 30	0.5 mls	1348a	8.4 b	1.5c	27.3a

* Disease ratings with 1 representing healthy plants and 5 representing 76-100% diseased plants.

** Means followed by the same letter do not significantly differ (P=0.05).

REPORT # 124 **SECTION K: CEREALS, FORAGE CROPS AND OILSEEDS**

CROP: Wheat (*Triticum aestivum* L.), cv. Biggar
PEST: Common Bunt (Covered Smut / Stinking Smut), *Tilletia caries*(DC) Tul.

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TITLE: EFFICACY OF PROSEED-WF2228 SEED TREATMENT FOR THE CONTROL OF COMMON BUNT DISEASE OF WHEAT

MATERIALS: PROSEED-WF2228 (hexaconazole, 5g/L), BAYTAN 30 (triadimenol, 317g/L)

METHODS: The trial was conducted at the Ag-Quest Research Station at Minto, Manitoba in 1997. All seeds for the trial were inoculated with the common bunt (*T. caries*) teliospores at the rate of 2.5g per 100g wheat seed. The seed treatment chemical and seed were put in a 6 L Erlenmeyer flask and agitated/swirled till all seed was uniformly coated with the fungicide. The seed treaments were: PROSEED (3ml / kg seed), PROSEED (4ml / kg seed), BAYTAN 30 (0.5 ml / kg) and untreated control. The trial was seeded on 28 May 1997 with a double disc press drill. The experimental design was randomized complete block design with four replications; plot size (2 m wide by 7.5 m in length). For over 3 weeks after planting there was no precipitation. Achieve 80DG (80% tralkoxydim) on 16 June and Achieve 80 + Buctril M (280g/L broxoxynil + 280g/L MCPA) on 4 July were used for weed control. Observations were taken on seedling emergence (12 June), yield/plot (harvested on 09 September 1997 and adjusted to 14% moisture), 1000 kernel weight and number of bunt infected seeds per 100g seed.

RESULTS: Seedling emergence in all treatments was similar (data not presented). All seed treatments significantly reduced the number of bunt infected seed as compared to the untreated control, and were not different from one another (Table 1). The seed treaments did not lead to significant increase in yields and did not affect the 1000 seed weight (data not presented).

CONCLUSIONS: Under the conditions of this trial, PROSEED-W2228 at 3ml and 4ml / kg seed and BAYTAN 30 worked equally well in reducing the bunt infection in wheat, but were ineffective in influencing either the yield or the seed weight.

Table 1. Effect of seed treatment with PROSEED-W2228 and BAYTAN 30 on common bunt infection and yield of wheat, cv Biggar, artificially inoculated with *Tilletia caries* teliospores, 1997 .

Treatment	Rate of Product ml / kg seed	Bunt Infected seed # / 100 g seed	Yield kg / ha
Untreated Control	-	39.5 a *	1177 a
PROSEED-WF2228	3	0.5 b	1229 a
PROSEED-WF2228	4	0.3 b	1217 a
BAYTAN 30	0.5	0.0 b	1329 a
LSD (P = 0.05)		3.4	327
Coefficient of Variation		20.9	16.5

* Means followed by the same letter do not differ significantly at P=0.05.

END OF SECTION K

SECTION L - **ORNAMENTALS, GREENHOUSES AND TURF**
/ PLANTES ORNEMENTALES, DE SERRE ET DE GAZON
- **Report/Rapports # 125 - 130**
- **Page # 326 - 338**

Section Editor: **Gary Platford**

PMR REPORT # 125 SECTION L: ORNAMENTALS, GREENHOUSE and TURF

CROP: Creeping bentgrass, *Agrostis palustris* Huds.
PEST: Dollar spot, *Sclerotinia homoeocarpa* (syn.: *Lanzia* or *Moellerodiscus sp.)*

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TITLE: CHEMICAL TRIALS FOR DOLLAR SPOT DISEASE CONTROL, SUMMER, 1996

MATERIALS: DACONIL 2787 4.1F (40.4% chlorothalonil), DACONIL ULTREX (82.5% chlorothalonil), DACONIL WEATHER STIK (54% chlorothalonil), EAGLE 40W (40% myclobutanil), FORE (48% mancozeb), LYNX 25DF (25% tebuconazole), LYNX 250EW (25% tebuconazole), TERSAN 1991 WP50 (50% benomyl).

METHODS: Eighteen treatments and controls were evaluated for dollar spot disease control on a 2-year-old sward of creeping bentgrass at the Guelph Turfgrass Institute in Guelph, Ontario. Turfgrass cultural treatments were similar to those used for maintenance of golf course putting greens in Ontario. The plots were irrigated as needed, and mowing height was set at 7 mm. The green was built to USGA specifications with an 80% sand component and a soil pH of 7.4. Sulphur-coated urea (N-P-K: 25-4-10) was applied annually in spring and fall at a rate of 2 kg/100 m^2. Experimental design consisted of a randomized complete block design with 4 replications. Each treatment plot measured 1 m x 2 m. Inoculum was prepared by incubating four strains of *Sclerotinia homoeocarpa* on autoclaved cereal grains (chicken scratch) for 2-3 weeks. The inoculum was dried and chopped into small particles with a mixer. Inocula from the four strains were mixed together, and 2 g plus 8 g of whole wheat flour were evenly applied to each plot. Inoculum was applied 2 days after the first fungicide treatments. Fungicides were first applied on 4 July 1996, with a wheel-mounted compressed air boom sprayer (140 kPa) in water at 11 L /100 m^2 using Lurmark 03-F110 nozzles. Fungicides were re-applied on a 14, 21 or 28-day schedule according to specifications over a 6-week period. Dollar spot disease was evaluated weekly for 9 weeks, by estimating number of infection centres per 1 m x 2 m plot. Significant yellowing due to phytotoxicity was noted if present. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD, p=0.05).

RESULTS: The 1996 season began with cool wet weather and then intermittent hot and cool spells.

Average disease pressure was experienced with the inoculated controls having counts similar to those of inoculated controls of 1993 and 1994. Results are presented in Table 1. A light natural infection was observed on 4 July when the initial evaluation was conducted and although the cobwebby mycelium of *S. homoeocarpa* was visible on 31 July, no increase in disease centres was apparent until 7 August.

CONCLUSIONS: Among the standard fungicides, TERSAN 1991 (30g - 21 days), provided excellent control of disease until 28 August. The other standard, DACONIL 2787 (180 ml - 14 days), showed excellent control of disease levels but exhibited more variation in control with counts showing a see-saw effect. LYNX 25DF (15g - 28 days) and LYNX 250EW (15g - 28 days) showed excellent control of dollarspot disease from 14 July to 28 August but, with higher initial infection, both were slower to reduce the levels of disease to acceptable numbers. Both LYNX treatments also began to show an increase on 28 August indicating the need for a slightly shorter treatment interval with higher disease pressure. EAGLE (30g - 21 days), EAGLE 40W plus FORE (20g, 400ml - 14 days) and EAGLE 40W plus DACONIL 2787 (20g, 190 ml - 21 days) achieved excellent results. EAGLE 40W plus DACONIL 2787 (20g, 95ml - 21 days) and EAGLE 40W (20g - 14 and 21 days) also performed well but were slow to reduce disease centres to aesthetically acceptable levels. This was probably due to higher initial infection. DACONIL 2787 plus TERSAN (120ml,20g -14 days) had excellent results after 17 July, and the initial lag in was probably due to higher initial counts in these plots. TERSAN 1991 and DACONIL ULTREX (30g,73g - 21 days), DACONIL WEATHER STIK (120ml - 14 days), DACONIL 2787 plus TERSAN (120ml,30g - 14 days) showed good control with some counts above the acceptable aesthetic value of 10. Although DACONIL ULTREX (73g - 14 days) significantly suppressed disease, it showed see-saw effects and did not provide acceptable aesthetic levels of disease control. No phytotoxicity was observed.

Table 1. Treatment, application rate, interval and counts of dollarspot disease during July and August 1996. Plots were inoculated with *Sclerotinia homoeocarpa* 2 days after the first treatment on 4 July and counts are number of spot in each 1 m by 2 m plot based on 4 replicates.

Treatment	Prod/ $100m^2$	Int (days)	Jul 4	Jul 11	Jul 17	Jul 24	Jul 31	Aug 7	Aug 14	Aug 21	Aug 28
UNINOCULATED			1	13	15	4	0	35	20	46	128
INOCULATED			3	70	106	50	8	415	285	365	320
DACONIL 2787	180 ml	14	5	0	1	0	0	5	16	0	11
TERSAN 1991	30 g	21	1	0	1	0	0	5	3	9	35
LYNX 25DF	15 g	28	30	14	26	8	0	9	0	1	42
LYNX 250EW	15 g	28	45	42	11	0	0	0	0	1	29
EAGLE 40W	20 g	14	18	15	8	0	0	0	0	0	0
EAGLE 40W	20 g	21	45	33	18	0	0	3	0	0	0
EAGLE 40W	30 g	21	21	6	3	0	0	0	0	0	0
EAGLE 40W+ FORE	20 g 400 g	14	1	0	0	0	0	0	0	0	0
EAGLE 40W	20 g	21	10	10	0	0	0	0	0	0	0
EAGLE 40W+ DACONIL 2787	20 g 95 ml	21	27	18	0	0	0	0	0	0	0
EAGLE 40W+ DACONIL 2787	20 g 190 ml	21	0	0	0	0	0	0	0	0	0
TERSAN 1991+ DACONIL ULTREX	30 g 73 g	14	66	45	0	1	0	7	6	1	13
DACONIL WEATHER	120 ml	14	14	3	6	0	0	13	8	1	19
DACONIL 2787+ TERSAN 1991	120 ml 30 g	14	103	81	10	1	0	17	16	5	22
DACONIL2787+ TERSAN 1991	120 ml 20 g	14	56	33	8	1	3	8	5	0	7
DACONIL ULTREX	73 g	14	55	25	48	10	5	68	49	6	48
LSD ($p = 0.05$)			65	70	77	34	6	27	45	8	66

PMR REPORT # 126 **SECTION L: ORNAMENTALS, GREENHOUSE and TURF**

CROP: Creeping bentgrass, *Agrostis palustris* Huds.
PEST: Dollar spot, *Sclerotinia homoeocarpa* (syn.: *Lanzia* or *Moellerodiscus sp.)*

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TITLE: CHEMICAL TRIALS FOR DOLLAR SPOT DISEASE CONTROL, SUMMER, 1997

MATERIALS: DACONIL 2787 4.1F (40.4% chlorothalonil), DACONIL ULTREX (82.5% chlorothalonil), DACONIL WEATHERSTIK SC (54% chlorothalonil), DACONIL WEATHERSTIK ZN (54% chlorothalonil) EAGLE 40W (40% myclobutanil), FORE (48% mancozeb), QUINTOZENE (75% pentachloronitrobenzene), TERRACHLOR (75% pentachloronitrobenze), TERSAN 1991 WP50 (50% benomyl).

METHODS: Eighteen treatments and controls were evaluated for dollar spot disease control on a 3-year-old sward of creeping bentgrass at the Guelph Turfgrass Institute in Guelph, Ontario. Turfgrass cultural management was similar to that used for maintenance of golf course putting greens in Ontario. Plots were irrigated as needed, and mowing height was set at 5 mm. Sulphur-coated urea (N-P-K: 25-4-10) was applied annually in spring and fall at a rate of 2 kg/100 m^2. Experimental design consisted of a randomized complete block design with 4 replications. Each treatment plot measured 1 m x 2 m. Inoculum was prepared by incubating four strains of *Sclerotinia homoeocarpa* on autoclaved cereal grains (chicken scratch) for 2-3 weeks. The inoculum was dried and chopped into small particles with a mixer. Inocula from the four strains were mixed together, and 2 g plus 8 g of whole wheat flour were evenly applied to each plot. Inoculum was applied 2 days after the first fungicide treatments. Fungicides were first applied on 2 July 1997, with a wheel-mounted compressed air boom sprayer (140 kPa) in water at 11 L /100 m^2 using Lurmark 03-F110 nozzles. Fungicides were re-applied on a 14, 21 or 28-day schedule according to specifications over a 6-week period. Dollar spot disease was evaluated weekly for 9 weeks, by estimating number of infection centres per 1 m x 2 m plot. Significant yellowing due to phytotoxicity was noted if present. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD, p=0.05).

RESULTS: The 1997 season began with dry weather for 5 weeks followed by intermittent hot and cool spells. Disease pressure was lower than average. Inoculated controls developed disease centres similar in number to previous years but with a smaller average size (approximately 2 cm diameter as compared to the normal size of 4 to 6 cm). Furthermore the development of disease on the uninoculated controls was very low. Results are presented in Table 1. Although the plots were inoculated on 2 July but no disease centres were apparent until 25 July.

CONCLUSIONS: Among the fungicide standards, Tersan 1991 (30g - 21 days), provided excellent control of disease. The other standard, Daconil 2787 (180 mL - 14 days), showed excellent control of disease levels until 30 July when the disease centres on the treated plots began to increase beyond the aesthetically acceptable criteria of 5 centres per square meter and continued to exhibit a seesaw effect for the remainder of the trial. All EAGLE treatments alone or in combination with either FORE or DACONIL performed well except for EAGLE (20 g/100m^2 - 14 days). This was surprising because the same treatment at a 21 day interval showed much better results. DACONIL ULTREX (120g - 14 days), DACONIL WEATHERSTIK SC and DACONIL WEATHERSTIK ZN (128 mL - 4 days) all provided good control but exhibited some seesaw effect. In our weekly evaluations, results were good at 7 days, and so treatments were not reapplied until the following week. However, by that time, disease severity exceeded acceptable levels. Treatment intervals of less than 14 days but more than 7 days probably would have provided acceptable to excellent levels of control. Also, higher rates for curative disease control (180g for granulars or 170 mL for liquids) may give better results. QUINTOZENE and TERRACHLOR treatments failed to reduce disease and also showed phytotoxicity.

Table 1. Treatment, application rate and schedule, and counts of dollar spot disease during July and August 1997. Plots were inoculated with *Sclerotinia homoeocarpa* 2 days after the first treatment on 2 July and counts are expressed as number of infection centres in each 1 m by 2 m plot based on 4 replicates.

Treatment	Prod/ $100m^2$	Interval (days)	July 2	July 9	July 16	July 25	July 30	Aug 6	Aug 14	Aug 20	Aug 27
UNINOCULATED			0.0	0.0	0.0	1.3	12.5	3.8	22.5	41.3	45.0
INOCULATED			0.0	0.0	0.0	190.0	230.0	265.0	240.0	255.0	250.0
DACONIL	180 ml	14	0.0	0.0	0.0	0.0	77.5	21.3	28.8	41.3	37.5
TERSAN	30 g	21	0.0	0.0	0.0	2.5	1.3	0.8	1.3	0.0	4.5
EAGLE	20 g	14	0.0	0.0	0.0	0.0	39.3	30.0	45.0	35.0	23.0
EAGLE	20 g	21	0.0	0.0	0.0	3.8	5.8	0.8	0.0	0.3	2.5
EAGLE	30 g	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EAGLE+	20 g										
FORE	400 ml	14	0.0	0.0	0.0	0.0	3.8	0.0	1.3	0.0	0.0
EAGLE+	20 g										
FORE	400 ml	21	0.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	6.3
EAGLE+	20 g										
DACONIL	95 ml	21	0.0	0.0	0.0	8.8	2.0	0.0	1.8	0.0	0.0
EAGLE+	20 g										
DACONIL	190 ml	21	0.0	0.0	0.0	10.5	3.8	0.0	10.0	0.0	0.0
DACONIL ULTREX	120 g	7-14	0.0	0.0	0.0	1.3	37.0	0.5	21.3	11.3	13.8
WEATHERSTIK SC	128 ml	7-14	0.0	0.0	0.0	0.0	63.8	3.8	7.5	0.0	10.0
WEATHERSTIK ZN	128 ml	7-14	0.0	0.0	0.0	0.0	50.0	1.3	11.3	6.3	2.5
QUINTOZENE	213 g	7-14	0.0	0.0	0.0	167.5	272.5	125.0	240.0	290.0	215.0
QUINTOZENE	305 g	7-14	0.0	0.0	0.0	180.0	230.0	95.0	170.0	270.0	200.0
TERRACHLOR	334 g	7-14	0.0	0.0	0.0	190.0	240.0	177.5	245.0	320.0	240.0
TERRACHLOR	476 g	7-14	0.0	0.0	0.0	142.5	192.5	95.0	170.0	210.0	200.0
LSD (P=0.05)			0.0	0.0	0.0	29.1	69.0	46.7	56.8	53.7	31.8

PMR REPORT # 127 **SECTION L: ORNAMENTALS, GREENHOUSE and TURF**

CROP: Creeping bentgrass, *Agrostis palustris* Huds.
PEST: Fusarium patch, *Microdochium nivale* (Fr.) Samuels & Hallett

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TITLE: CHEMICAL TRIALS FOR FUSARIUM PATCH DISEASE CONTROL, SPRING, 1996

MATERIALS: DACONIL 2787 4.1F (40.4% chlorothalonil), DACONIL ULTREX (82.5% chlorothalonil), EAGLE 40W (40% myclobutanil), FORE 480F (48% mancozeb), HERITAGE (50% azoxystrobin), LYNX 25DF (25% tebuconazole), LYNX 250EW (25% tebuconazole), ROVRAL 240SC (24% iprodione), ROVRAL GREEN (25% iprodione), TERSAN 1991 WP50 (50% benomyl).

METHODS: Eighteen treatments and controls were evaluated on a 2-year-old sward of creeping bentgrass (*Agrostis palustris*) at the Guelph Turfgrass Institute, Guelph, Ontario. Turfgrass cultural treatments were similar to those used for maintenance of golf course putting greens in Ontario. Sulfur-coated urea (N-P-K: 25-4-10) was applied at a rate of 2 kg/100 m^2 in April and November annually. The plots were irrigated as needed, and mowing height was set at 5 mm. The underlying soil was a Fox sandy loam with a pH of 6.8. Experimental design consisted of a randomized complete block design with 4 replications. Each treatment plot measured 1 m x 2 m. Control of Fusarium patch, caused by *Microcodochium nivale* (syn.: *Fusarium nivale* or *Gerlachia nivalis*), was evaluated in these trials. Inoculum was prepared by incubating the 3 strains of *M. nivale* on autoclaved cereal grains (chicken scratch) for 2-3 weeks. The inoculum was dried and chopped with a mixer into small particles. Inocula from the 3 strains were mixed togther, and 2 g plus 8 g of whole wheat flour as a carrier were evenly applied to each plot. Inoclum was applied 2 days after initial fungicide treatments. Fungicide treatments were first applied on 17 April 1996, with a wheel-mounted compressed air boom sprayer at 140 kPa in water at 11 L /100 m^2 using Lurmark 03-F110 nozzles. Fungicides were re-applied on a 7, 14, 21 or 28-day schedule according to specifications over a 5 week period. Fuarium patch disease was evaluated weekly for 7 weeks by estimating percent area infected per 1 m x 2 m plot. Significant yellowing due to phytotoxicity was noted if present. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD).

RESULTS: Fusarium patch was prevalent during spring of 1996 due to the cool and wet weather conditions . The inoculated and uninoculated controls were not significantly different from each other up to 23 May. Fusarium patch disease severity over 7 weeks is presented in Table 1. No phytotoxicity was observed.

CONCLUSIONS: Although all treatments showed significant suppression of disease by the end of the test, recovery seemed to be faster for some treatments, especially HERITAGE (6.1 g/100m^2) and

EAGLE 40W (400 ml/100m^2). The following treatments also deserve mention for suppressing disease and allowing statistically significant recovery 2 weeks before the rest of the treatments: HERITAGE (9.15 g and 12.2 g /100m^2), FORE (400 ml /100m^2), FORE + EAGLE (400 ml + 30 g /100m^2), DACONIL + TERSAN (120 ml + 30 g /100m^2), ROVRAL (250 ml /100m^2) and LYNX (30 g/100m^2).

Table 1: Treatment, fungicide application rate and interval, and % area affected by Fusarium patch disease during 7 weeks beginning 17 April, 1996. Plots of 1 m by 2 m with 4 replicates were located at the Guelph Turfgrass Institute.

Treatment	Prod /100m^2	Interval (days)	Apr 17	Apr 24	May 2	May 8	May 16	May 23	May 29	Jun 6
UNINOCULATED			2.1	2.3	2.0	1.5	11.3	12.5	7.5	13.8
INOCULATED			2.8	2.8	3.3	3.0	6.5	10.5	7.5	5.5
HERITAGE	6.1 g	14	1.0	0.8	0.5	0.5	0.3	0.5	0.3	0.3
HERITAGE	9.15 g	14	2.3	1.5	2.3	2.3	2.5	3.5	2.0	1.0
HERITAGE	12.2 g	14	1.8	2.0	2.3	1.0	2.0	2.5	0.8	1.0
FORE 480F	400 ml	14	2.3	1.8	1.5	1.5	1.8	2.5	1.5	1.5
EAGLE 40W	30 g	14	0.8	0.8	0.5	0.8	0.8	1.0	0.3	1.0
FORE 480F +	400 ml	14								
EAGLE 40W	30 g	14	1.3	0.8	1.0	0.8	1.0	1.5	1.3	0.5
TERSAN 1991	60 g	14	3.5	3.3	3.3	3.5	3.5	4.5	1.8	2.3
DACONIL ULTREX	73 g	7	2.8	3.3	4.0	3.3	3.3	6.5	2.5	2.0
DACONIL 2787+	120 ml	14								
TERSAN 1991	30 g		1.3	1.8	1.0	0.8	0.8	1.8	0.3	0.3
ROVRAL 240SC	187.5 ml	28	2.8	2.3	2.0	2.5	4.0	4.8	1.3	2.3
ROVRAL 240SC	250 ml	28	1.5	1.0	1.0	1.3	1.0	0.5	0.3	0.3
LYNX 25DF	30 g	30	2.5	2.8	2.0	2.0	3.0	4.3	1.0	1.3
LYNX 250EW	15 g	30	2.3	2.0	2.0	2.3	3.8	5.0	2.0	1.5
LYNX 250EW	30 g	30	1.8	1.5	1.3	1.5	2.5	5.3	1.3	2.0
LSD (P=0.05)			2.4	2.9	2.8	2.7	4.1	6.8	2.3	2.7

PMR REPORT # 128 **SECTION L: ORNAMENTALS, GREENHOUSE and TURF**

CROP: Creeping bentgrass, *Agrostis palustris* Huds.
PEST: Grey snow mould, *Typhula incarnata* Fr. and *T. ishikariensis* Imai
Pink snow mould, *Microdochium nivale* (Fr.) Samuels & Hallett

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TITLE: CHEMICAL TRIALS FOR GREY SNOW MOULD CONTROL, WINTER, 1996-1997

MATERIALS: ARREST 75W (20% carbathiin, 5% oxycarboxin, 50% thiram), BANNER 1.1EC (14% propiconazole), DACONIL 2787 (40.4% chlorothalonil), EAGLE 40W (40% myclobutanil), FORE 480F (48% mancozeb), HERITAGE (50% azoxystrobin), PCNB 75WP (75% pentachloronitrobenze), QUINTOZENE 75WP (75% pentachloronitrobenze), ROVRAL GREEN (25% iprodione), TERSAN 1991 (50% benomyl).

METHODS: Chemical and control treatments were evaluated on a 2-year-old sward of creeping bentgrass (*Agrostis palustris*) at the Guelph Turfgrass Institute, Guelph, Ontario. Turfgrass cultural treatments were similar to those used for maintenance of golf course putting greens in Ontario. The snow mould diseases caused by *Typhula* species (grey snow mould), and *Microdochium nivale* (pink snow mould) were evaluated in fungicide trials. Inoculum was prepared by incubating the fungi on autoclaved cereal grains (chicken scratch) for 1 month (pink) and 3 months (grey). The inoculum was dried overnight and chopped with a mixer into small particles. Inocula from five strains each of the grey snow mould fungi (*T. ishikariensis* and *T. incarnata*) were mixed and combined with another 9 parts of dried, autoclaved and chopped cereal grains. Fifteen grams were evenly applied to each plot 2 days after fungicide applications. Pink snow mould inocula was similarly formulated and applied. Experimental design consisted of a randomized complete block design with 3 replications on 1 m x 1.5 m plots for each snow mould disease. Chemicals were applied on 3 December 1996, with a wheel-mounted compressed air boom sprayer at 140 kPa in water at 10 L/100 m^2 using Lurmark 03-F110 nozzles. The diseases were evaluated after snowmelt by estimating percent area affected. Due to interruptions in snow cover, grey snow mould did not develop severely on the plots and did not form sclerotia to distinguish this disease from pink snow mould, and hence results for the two snow moulds were pooled. Plots were evaluated on 11 April for disease and on 23 April for greenup. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD, P=0.05). Five percent area affected or less was used as the criterion for efficacious control of either snow mould disease.

RESULTS: The temperatures in December were around freezing with no snow cover until 6 January 1997. Snow cover was intermittent with continuous cover for 16 days in January, 10 days in February and 24 in March, with ice cover from mid-January to mid-February. Snow fall and snow cover are critical in the development of winter diseases. Most injury was due to pink snow mould and was limited.

Ground temperatures fluctuated between +2 and -6 °C until the end of March with only 9 days above +2 and 6 days below -6 °C. Inoculated and uninoculated controls showed no significant differences in greenup or disease injury. Results are presented in Table 1.

CONCLUSIONS: The following treatments did not provide significant disease control on either 2 Apr or 11 Apr: DACONIL 2787 (512 ml/100m^2), FORE 480F (400 ml/100m^2). The following were not significantly different from the inoculated control only on the second reading (11 Apr): TERSAN (125 g/100m^2), EAGLE 40W (30 g/100m^2) and ARREST 75W (250 g/100m^2). The rest of the treatments provided significant disease control.

Table 1. Disease severity (% area affected) and greenup (1 = low, 2 = medium and 3 = high greenness) of plots inoculated with *Typhula* spp. or *Microdochium nivale*. Values are the mean of six replicate 1 m by 1.5 m plots.

Treatment	Product / 100 m^2	%Area affected		Greenup
		2 Apr	11 Apr	23 Apr
UNINOCULATED		10.0	10.0	1.0
INOCULATED		15.8	13.3	1.0
DACONIL 2787	512 ml	15.2	15.2	1.3
ROVRAL GREEN	360 ml	0.5	1.5	1.0
TERSAN	125 g	8.7	8.0	1.0
DACONIL 2787+ ROVRAL GREEN	240 ml+ 120 ml	2.5	1.7	1.3
DACONIL 2787+ TERSAN 1991	240 ml + 125 g	1.7	0.7	1.0
DACONIL 2787+ BANNER 1.1EC	240 ml + 195 ml	5.2	4.7	1.0
DACONIL 2787+ PCNB 75WP	240 ml + 320 g	2.7	1.8	1.7
DACONIL 2787+ EAGLE 40 W	240 ml + 20 g	4.0	3.3	1.0
EAGLE 40W	30 g	8.3	8.7	1.0
EAGLE 40W	60 g	5.0	4.2	1.0
EAGLE 40W + FORE 480F	20 g + 400 ml	7.0	7.7	1.3
EAGLE 40W + FORE 480F	30 g + 400 ml	1.0	1.7	1.3
EAGLE 40W + FORE 480F	60 g + 400 ml	5.0	3.7	1.3
FORE 480F	400 ml	10.0	9.1	1.0
ARREST 75W	250 g	6.3	7.0	1.1
ARREST 75W	375 g	2.0	1.5	1.7
QUINTOZENE	250 g	0.8	0.5	1.3
HERITAGE	6.1 g	0.0	0.0	1.0
HERITAGE	9.15 g	0.0	0.0	1.0
HERITAGE	12.2 g	1.0	0.5	1.0
LSD (P=0.05)		6.4	6.9	0.8

PMR REPORT # 129 **SECTION L: ORNAMENTALS, GREENHOUSE and TURF**
ICAR: 61006536

CROP: Bentgrass, cv Penncross
PEST: Dollar Spot, *Sclerotinia homeocarpa*

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TITLE: CONTROL OF DOLLAR SPOT IN TURF

MATERIALS: ICIA 5504 50WG (azoxystrobin), DACONIL 2787 FLOWABLE (chlorothalonil), LYNX 25%DF (tebuconazole), ROVRAL GREEN (iprodione).

METHODS: A research bentgrass green located at Ridgetown College was allowed to be naturally infected with Dollar Spot. Fungicides were then applied on July 28, 1997, in a curative procedure. The foliar applications were applied using a specialized small plot research CO_2 sprayer with a two-nozzled hand-held boom, applying 200 L/ha of spray mixture. The plot size was 10m by 1m , replicated 2 times in a randomized complete block design. Assessments were made by visually rating the level of recovery compared to the untreated area on July 29, August 1, 5, 12 and 19. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: The most effective fungicide used for the eradicative control of Dollar Spot on a bentgrass turf was LYNX 25%DF. ROVRAL GREEN gradually improved the control of this disease and by the third week of the trial provided equal control to that of LYNX 25%DF. DACONIL 2787 FLOWABLE showed similar control of Dollar Spot to that of ROVRAL GREEN early, however considerably more Dollar Spots were noticed 21 days after applications. ICIA 5504 50WG was ineffective in the control of Dollar Spot in turf.

Table 1. Control of Dollar Spot in turf

Treatments	Rate Product/m^2	Visual Recovery Ratings (0-10)[1]				
		July 29	Aug. 1	Aug. 5	Aug. 12	Aug 19
ICIA 5504 50WG	0.12 g	1.0 a*	1.0 b	2.0 c	2.0 c	2.0 c
DACONIL 2787	1.0 ml	1.0 a	2.5 a	7.5 b	7.5 b	4.5 b
LYNX 25%DF	0.62 g	1.0 a	2.5 a	9.0 a	10.0 a	10.0 a
ROVRAL GREEN	1.2 ml	1.0 a	2.0 ab	6.5 b	7.5 b	8.5 a
CONTROL		1.0 a	1.0 b	1.0 c	1.0 c	1.5 c
ANOVA P• 0.05		ns	s	s	s	s
Coefficient of Variation (%)			21.5	9.6	8.9	11.2

* These values are the means of two replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Visual Recovery Ratings (0-10) - 0, no recovery, no control, turf foliage severely damaged; 10, maximum recovery, complete control.

PMR REPORT # 130 **SECTION L: ORNAMENTALS, GREENHOUSE and TURF**
ICAR: 61006536

CROP: Turf type perennial ryegrass, cv. Cutter
PEST: Pythium Blight, *Pythium aphanidermatum*

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TITLE: PYTHIUM BLIGHT CONTROL IN TURF

MATERIALS: ICIA 5504 50WG (azoxystrobin), DACONIL 2787 FLOWABLE (chlorothalonil), LYNX 25%DF (tebuconazole), ROVRAL GREEN (iprodione).

METHODS: Perennial ryegrass was seeded in 1m^2 surface area flats in a soilless mixture on June 15, 1997. The seeded flats were placed in a plastic covered greenhouse in an attempt to maximize the warm moist condition suitable for Pythium growth. The test procedure consisted of a single fungicide treatment applied on July 23 followed by the immediate inoculation with the fungal organism sprinkled evenly over the turf trays. Two additional inoculations on July 30 and August 6 were made to evaluate the long-term fungicidal suppression of this disease. The foliar applications were applied using a specialized small plot research CO_2 sprayer with a two-nozzled hand-held boom, applying 200 L/ha of spray mixture. A culture of *Pythium aphanidermatum* was obtained from the turf research program at Pennsylvania State College. Inoculum was prepared by growing a virulent isolate of *Pythium aphanidermatum* on autoclaved rye grain for approximately one week. Rye flasks were prepared by placing 225 g of rye grain, 4 g of $CaCO_3$, and 275 ml of water in 1,000 - ml Erlenmeyer flasks; stopping with cotton plugs; autoclaving for 30 minutes at 15 psi. Inoculation consists of spreading 20 Pythium-infected rye kernels on each plot. After inoculation, the contaminated areas were irrigated, then subsequently misted for one minute every hour from 8 am to 8 pm every day. The minimum temperature recorded from July 23 to August 12 was 24C while the maximum temperature in the plastic greenhouse during this period was 30C. The plot size were 1m^2 flats (surface area) replicated 4 times. Assessments were made on July 28, August 5 and 12 by rating the amount of disease coverage over the turf flat. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Table 1.

CONCLUSIONS: The method of inoculation and the conditions in the greenhouse provided excellent Pythium conditions. The turf was colonized within 5 days of inoculation with the white mycelium of Pythium causing severe damage to the turf. The only product that was able to control Pythium Blight under these conditions was ICIA 5504 50WG. This product gave outstanding and continued control of this disease for at least a 2-3 week period. DACONIL 2787 FLOWABLE and ROVRAL GREEN provided a measure of early suppression but became overgrown with the disease organisms after the first 5 days. LYNX 25% DF was ineffective in this trail.

Table 1. Pythium Blight control in turf

Treatments	Rate Product/m^2	Foliar Damage Ratings (0-10)[1] July 28	August 5	August 12
ICIA 5504 50WG	0.12 g	9.5 a*	9.4 a	7.0 a
DACONIL 2787 FLOWABLE	1.0 ml	5.0 b	2.5 b	2.0 b
LYNX 25%DF	0.62 g	3.0 c	1.5 b	1.0 b
ROVRAL GREEN	1.2 ml	5.5 b	2.0 b	1.0 b
CONTROL		2.0 c	1.0 b	1.0 b
ANOVA P• 0.05		s	s	s
Coefficient of Variation (%)		12.5	4.6	5.6

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] Foliar Damage Ratings (0-10) - 0, no control, turf foliage severely damaged; 10, complete control.

END OF SECTION L

SECTION M - **NEMATODES / NÉMATODES**
- **Report/Rapport # 131**
- **Page # 339 - 341**

Section Editor - **Joe Kimpinsky**

PMR REPORT # 131 **SECTION M:** **NEMATODES**
ICAR: 61006536

CROP: Field Tomatoes cv. Heinz 9478
PEST: Root lesion nematode, *Pratylenchus penetrans* (Cobb) Filip. & Stek.
Northern root-knot nematode, *Meloidgyne hapla* Chipwood
Stunt nematode, *Tylenchorhynchus* spp.
Spiral nematode, *Rotylenchus* spp., *Helicotylenchus* spp.
Verticillium wilt, *Verticillium* spp.

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TITLE: BROADCAST TREATMENTS FOR THE CONTROL OF NEMATODES AND VERTICILLIUM IN FIELD TOMATOES.

MATERIALS: E3274 (experimental nematicide), TELONE II (dichloropropene), VAPAM (metam-sodium)

METHODS: Tomatoes were planted in twin-rows on single bed plots, 8m in length with rows spaced 1.65m apart, replicated five times and treated as a randomized complete block design. Tomato beds were clustered into 4 beds per treatment, with the first row treated, the second row untreated, the third and fourth rows treated with TELONE II and VAPAM respectively to accommodate treating full row lengths with commercial soil fumigant equipment. TELONE II and VAPAM were knifed into the soil on April 22 at rates of 44 L/acre - TELONE II; and 75 L/acre - VAPAM. Seedlings were transplanted using a commercial transplanter on June 10, 1997. The E3274 nematicide material was applied as a broadcast treatment either prior to transplanting,(PPI) preplant incorporated on May 26, (incorporated by hand-raking) or as a post-emergence broadcast treatment (POST) directed to the sides of the tomato plants on July 8 and shallowly hand-raked into the soil. E3274 was applied using a specialized small plot research CO_2 sprayer with a two-nozzled hand-held boom, applying 200 L/ha of spray mixture. Foliar injury ratings were taken throughout the season. Soil samples were taken on July 3 and August 13 and sent for analysis to the Pest Diagnostic Clinic at the University of Guelph. The number of nematodes are recorded on the basis of counts per kg of soil. Yields were taken on September 22. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Data are presented in Tables 1 & 2.

CONCLUSIONS: Root-lesion nematode populations were high, well over the 1000/kg of soil action threshold. However, root-knot and, in particular the vascular wilt fungus Verticillium populations were lower.

E3274 effectively reduced both the root-lesion and root-knot nematode populations to below the action threshold at the high PPI rate and the higher tested rate of the combination PPI followed by the soil treatment by August 13. The level of root-lesion nematode control was reflected in increased tomato yields. There were no visual signs of phototoxicity with the use of E3274. The standard soil fumigant treatments, VAPAM and especially TELONE II significantly reduced nematode populations and increased tomato yields. Further increases in yield would have been expected with such high root-lesion nematode populations, however there were low verticillium counts.

Table 1. Nematode and Verticillium counts from soil samples taken on July 3. Nematode and Verticillium counts record the number per kg of soil. Total nematode counts include stunt and spiral nematodes as well as root lesion and root-knot nematodes.

Treatments[1]	Rate ml product/ha	Timing of Appl'n[2]	#/kg of soil sampled August 13			Verticillium
			Root Lesion Counts	Root-Knot	Total Nematode	Counts
Control			2164 a-d*	0	2180 a-d	1.5
E3274	935.4	PPI	3356 ab	0	3364 ab	3.5
E3274	1871	PPI	2156 a-d	16	2244 a-d	3
E3274	2806	PPI	1292 cde	0	1316 cde	2
E3274	3742	PPI	1394 cde	16	1446 cde	1
E3274	7483	PPI	925 de	0	755 de	17
E3274;	935.4	PPI				
E3274	935.4	POST	3744 a	0	3744 a	6.5
E3274;	1403.0	PPI				
E3274	1403.0	POST	3092 abc	0	3092 abc	10
E3274;	1871.0	PPI				
E3274	1871.0	POST	2100 a-d	0	2112 a-d	5.5
E3274;	3741.0	PPI				
E3274	3741.0	POST	1704 b-e	8	1712 b-e	4.5
TELONE II	110.0 L	BC	244 e	0	256 e	4
VAPAM	187.5 L	BC	172 e	0	172 e	3.5
ANOVA P• 0.05			s	ns	s	ns
Coefficient of Variatioon (%)			66.9		68.1	

* These values are the means of five replications. Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] separating PPI and post treatments

[2] PPI - preplant incorporated, POST - post emergence treatment, BC - broadcast

Table 2. Nematode counts from soil samples taken on August 13. Nematode counts record the number per kg of soil. Total nematode counts include, stunt and spiral nematodes as well as root lesion and root knot nematodes. Yields include both red and green tomato fruit.

Treatments[1]	Rate ml product/ha	Timing of Appl'n[2]	#/kg of soil sampled July 3 Root Lesion	 Root-Knot	 Total Nematode Counts	Yield Tonne/ha
Control			11968 a*	312 a	12352 a	56.1 b
E3274	935.4	PPI	4364 b	936 a	5656 b	56.0 b
E3274	1871	PPI	2160 b	128 a	2300 b	59.4 ab
E3274	2806	PPI	1592 b	0 b	1652 b	55.6 b
E3274	3742	PPI	2064 b	0 b	2080 b	66.1 ab
E3274	7483	PPI	872 c	0 b	1128 b	70.3 ab
E3274; E3274	935.4 935.4	PPI POST	3792 b	92 ab	3852 b	55.6 b
E3274; E3274	1403.0 1403.0	PPI POST	2852 b	20 ab	2944 b	51.1 b
E3274; E3274	1871.0 1871.0	PPI POST	1524 b	94 ab	2240 b	52.2 b
E3274; E3274	3741.0 3741.0	PPI POST	804 c	20 ab	840 c	57.4 ab
TELONE II	110 .0L	BC	28 d	0 b	28 d	77.3 a
VAPAM	187.5 L	BC	740 c	176 a	932 bc	69.7 ab
ANOVA P• 0.05			s	s	s	s
Coefficient of Variation (%)			89.9	79.8	92.4	22.7

* These values are the means of five replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

[1] separating PPI and post treatments

[2] PPI - preplant incorporated, POST - post emergence treatment, BC - broadcast

END OF SECTION M

PEST MANAGEMENT METHODS/MÉTHODES DE LUTTE DIRIGÉE
SECTION N - BIOLOGICAL CONTROL/LUTTE BIOLOGIQUE

- Weeds/Mauvaises herbes
- Insects, Mites, Nematodes

- Reports/Rapports # 132 - 133
- Page # 342 - 345

Section Editor - Dr. David Gillespie

See also Reports # 4-7, 15-17, 26, 39, 40, 43, 45, 47-48, 52, 54, 59 for related reports

PMR REPORT # 132 SECTION N: BIOLOGICAL CONTROL

CROP: Corn (*Zea mays)*
PEST: European corn borer (*Ostrinia nubilalis*)
Fall armyworm (*Pseudaletia unipuncta*),
Seedcorn maggot fly (*Delia platura*)

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TITLE: CONTROLLING INSECT PESTS OF CORN IN ONTARIO USING ENTOMOPHILIC NEMATODES

MATERIALS: Entomophilic nematodes: *Steinernema carpocapsae*; Insects: larvae of European corn borer, Fall armyworm and Seedcorn maggot fly; Plants: sweet corn plants and seeds

METHODS: The entomophilic nematodes, *S. carpocapsae* were used to infect the larvae of the European corn borer, Fall armyworm and Seedcorn maggot fly. Initially, 5 insect larva were put on a Petri dish containing a moist filter paper. Each insect larva was exposed to either 25 or 50 nematodes for 7 days at 20^0 C. After 7 days, the insects that died or pupated were transferred to white traps for 15 additional days to extract entomophilic nematodes. After the initial screening, five larvae of the European corn borer were put on 4 week old corn plants. Each plant was sprayed with 1250 nematodes. Seven days post-inoculation, dead and pupated European corn borer insects were transferred to white traps for 15 days. Similarly, after the initial screening, five larvae of the Fall armyworm were put on Petri dishes containing 50 gr of soil and corn leaves. Each Petri dish was inoculated with 1250 nematodes (250 nematodes per insect). Seven days post-inoculation, dead and pupated Fall armyworms were transferred to white traps for 15 days. The Seedcorn maggot larvae where treated as the Fall armyworm but the Seedcorn maggots were kept in 50 gr soil containing germinating corn seeds. In the control treatments, the larvae of all the above insects were kept under the same conditions as the treated groups but without the presence of nematodes. Each experiment consisted of 5 trials and each trial was repeated 10 times. Data was analysed using the Student t-test.

RESULTS: The entomophilic nematode, *S. carpocapsae* killed on average 60% to 80% of the Seedcorn maggot larvae while only 6% of the controls died. Similarly the nematodes killed 70% to 80% of the Fall army worm larvae while only 5%-10% of the larvae in the control treatment died. However, only 20% to 25% of the European corn borer larvae were killed by the nematodes; 5%-8% of the larvae in the control treatment died. No significant difference was observed between the Petri dish treatments and the soil and corn plant treatments.

CONCLUSIONS: The entomophilic nematode, *S. carpocapsae* can provide sufficient control of the Seed corn maggot fly and the Fall armyworm under Petri dish and greenhouse conditions. However, this entomophilic nematode did not provide sufficient control of the European corn borer. Therefore, additional work will be performed against the European corn borer, using a number of different entomophilic nematode species.

PMR REPORT # 133 **SECTION N: BIOLOGICAL CONTROL**
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank and cv. Shepody
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
PREDATOR: Two-spotted stinkbug, *Perillus bioculatus* (Fabr.)

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TITLE: UTILISATION OF THE TWO-SPOTTED STINKBUG TO CONTROL COLORADO POTATO BEETLES IN NEW BRUNSWICK

MATERIALS: *Perillus bioculatus* (Fabr.)

METHODS: Approximately 32,000 live *P. bioculatus* were provided by the USDA APHIS Mission Biological Control Laboratory, Texas. The insects, packed in plastic gallon containers were released in Florenceville, New Brunswick in research blocks at the McCain Research Farm. Blocks consisted of 32, 30 m long rows spaced 0.9 m apart. There were four replications planted on May 27, 1996; two were Russet Burbank, planted at 46 cm within row spacing, and two were Shepody, planted 25 cm within row spacing. Approximately 8,000 pentatomid nymphs were released in each Release block. There were five release sites in each block (~1600 nymphs at each site); four release sites were 8 rows in from the edge of the block and 3 m in from the end of the row; the fifth release site was in the middle of row 16. The pentatomid nymphs were released on July 12, 1996 by placing open 2 L plastic buckets containing ~1600 nymphs in black plastic netting on top of the potato hill under the canopy of two plants. The buckets were removed on July 12 and the plastic netting was spread out under the plant canopy to allow any remaining nymphs to move to potato plants. The netting was removed on July 15. Four blocks, two Russet Burbank and two Shepody) where pentatomid nymphs were not released were used as checks. A plastic (4 mil) lined trench surrounding the blocks, 8 m from the block edges was installed on May 30 to trap colonizing Colorado potato beetles. NOVODOR, for Colorado potato beetle control, was applied to the Release blocks on June 28, July 3 and 11 (5 L product/ha) and to the check blocks on July 18 and 23 (7.5 L product/ha). To measure the rate of predator dispersal from the release points, specific potato plants were sampled for pentatomid nymphs. The plant closest to the release site (P0), the third plant in the same row on either side of the release plant (P3), the sixth plant within the row on either side of the release plant (P6), the plants directly opposite the release plant in the rows on either side of the release plant (R1), and in the second row on either side of the release plant (R2). Plants P0, P3 and R1 were sampled on July 12, 15 and 18. All the above plants were sampled on July 22 and 24. On Aug 1, 5, 8 and 12 the number of pentatomid nymphs were counted on five randomly selected plants per block. T-tests were performed on the count data on a block basis for the Aug 1, 5, 8 and 12 sample dates. On the other sample dates the average number of pentatomid nymphs per plant at each release site was used as the data for one plant and the five release sites in each block were used as the five randomly-selected plants used in later sampling.

RESULTS: The accidental application of a bacterial insecticide on the plots the day before the release of the predator prevented us from separating the effect of the two respective treatments. Beetle control was similar for predator and bacterial insecticide and bacterial insecticide alone. However, it should be noted that in the bacterial insecticide alone it became necessary to resume insecticide applications thereby indicating that the combined predator and bacterial insecticide treatment provided longer lasting control. There was a rapid dispersal of pentatomid nymphs over immediately adjacent plants and rows adjacent to the release point. The predators did not move from the release blocks into the check blocks until July 22 (Table 1).

CONCLUSIONS: Field release of 32,000 *P. bioculatus* in clumps of 1,600 in 1996 showed a rapid dispersal of the nymphs over immediately adjacent plants and rows. However, it took about 10 days before the nymphs were recovered from the neighbouring control blocks. These observations support conclusions made elsewhere that these predators should be released uniformly over a field to maximize their effectiveness. The trial did not succeed at measuring the efficacy of the two spotted stinkbug but showed that it can at least extend the effectiveness of recommended control methods under New Brunswick conditions.

Table 1. Mean number (± S.E.) of *P. bioculatus* nymphs on five plants per treatment throughout the sampling period.*

Date	Treatment	
	Release	Check
July 12	28.05 ± 3.84a	0.00 ± 0.00b
July 15	7.90 ± 1.41a	0.00 ± 0.00b
July 18	1.90 ± 0.58a	0.00 ± 0.00b
July 22	3.80 ± 0.69a	0.10 ± 0.10b
July 24	1.95 ± 0.22a	0.05 ± 0.05b
August 1	0.75 ± 0.48	0.25 ± 0.25
August 5	0.00 ± 0.00	0.00 ± 0.00
August 8	0.75 ± 0.75	0.25 ± 0.25
August 12	0.50 ± 0.29	0.00 ± 0.00

* Figures are means of four replications. Numbers in a row followed by the same letter are not significantly different according to a t-test (P• 0.05).

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List 1. PRODUCTS / COMMON or ALTERNATIVE NAMES

abamectin	AGRI-MEK, AVID
ABG-6444, ABG-6445, ABG-6472, ABG-6473	*Bacillus thuringiensis var. tenebrionis*
ACM941	fungal biocontrol agent, AAFC, Morden
ACROBAT	dimethomorph + mancozeb
ADMIRE	imidacloprid
AGRI-MEK	abamectin
AGRICULTURAL STREPTOMYCIN	streptomycin sulfate
ALERT	chlorfenapyr
ALIETTE	fosetyl
APRON	metalaxyl
ARREST	carbathiin, oxycarboxin + thiram
AVID	abamectin
azinphosmethyl	GUTHION, SNIPER
azoxyatrobin	HERITAGE, QUADRIS, ICIA 5504
BANNER	propiconazole
BAS 490	kresoxim-methyl
BAY NTN 33983	imidacloprid
BAYLETON	triadimefon
BAYTAN	triadimenol
BELMARK	fenvalerate
BENLATE	benomyl
BRAVO	chlorothalonil
BRAVO ZN	chlorothalonil
BRAVO ZN	tetrachloroisophthalonitrile
CALCIMAX	calcium + boron
CAN0243	raxil-thiram
CAPTAN	captan
CARZOL	formetanate hydrochloride
COMPANION	spreader/sticker, octlphenoxyployethoxy -(9)-ethanol
COMPLY	fenoxycarb
CONFIRM	tebufenozide
CROWN	carbathiin + thiabendazole
CURZATE	cymoxanil
CURZATE-M	mancozeb + cymoxanil
CYGON	dimethoate
CYMBUSH	cypermethrin
cypermethrin	CYMBUSH, RIPCORD
D.Z.N.	diazinon
DACONIL	chlorothalonil
DACONIL ULTREX	chlorothalonil
DADS	diallyl disulphide
DECIS	deltamethrin
DIAZINON	diazinon
DIPEL	*Bacillus thuringiensis* var. *kurstaki* Berliner
DITHANE M-22	maneb
DITHANE DG	mancozeb
DIVIDEND XL	difenconazole + metalaxyl-m
DIVIDEND	difenoconazole
DPDS	n-propyl disulphide
DYFONATE	fonofos

DYNOMITE	pyridaben
E3274	experimental nematicide
EAGLE	myclobutanil
FLUAZINAM	fluazinam
FOLICUR	hexaconazole
FORCE	tefluthrin
FORE	mancozeb
FURADAN	carbofuran
GOLD LEAF	n-decanol (sucker control agent)
GOVERNOR	cyromazine
GUSTAFSON LSP	thiabendazole
GUTHION	azinphosmethyl
HERITAGE	azoxystrobin
IB11522	chlorothalonil
IB11923	ISK BioSciences experimental
ICIA 5504	azoxystrobin
imidacloprid	ADMIRE, BAY NTN 33983
KOCIDE	copper hydroxide
KUMULUS	sulphur
LINDANE	gamma BHC
LORSBAN	chlorpyrifos
LYNX	tebuconazole
MAESTRO	captan
MALATHION	malathion
MANZATE	mancozeb
MATADOR	cyhalothrin-lambda
METASYSTOX-R	oxydemeton-methyl
MONITOR	methamidophos
MYCOTROL	*Beauveria bassiana*
NOVA	myclobutanil
NOVODOR	*Bacillus thuringiensis* var. *tenebrionis*
NUTRICAL	calcium
ORTHENE	acephate
PBO	piperonyl butoxide
PCNB	pentachloronitrobenze
PENNCOZEB	mancozeb
PIRIMOR	pirimicarb
PRO GRO	carbathiin + thiram
propiconazole	BANNER, TILT, TOPAS, TOPAZ
PROSEED	hexaconazole
PYRAMITE	pyridaben
PYRIFOS	chlorpyrifos
QUADRIS	azoxystrobin
QUINTOZENE	pentachloronitrobenzene
RAXIL	tebuconazole
REGENT	fipronil
RH-5992	tebufenozide
RIDOMIL GOLD MZ	metalaxyl-m + mancozeb
RIDOMIL MZ	metalaxyl + mancozeb
RIPCORD	cypermethrin
ROVRAL	iprodione

SEVIN XLR PLUS	carbaryl
SNIPER	azinphosmethyl
SPINOSAD	spinosyn, *Saccharopolyspora spinosa*
SPINOSAD	NAF85
SUPERIOR OIL	acaricidal petroleum oil
SUPERTIN	triphenyltin hydroxide
TATTOO	propamocarb + chlorothalonil
TBZ	thiabendazole
TD 2344-02	synthetic pyrethrinoid
TELONE II	dichloropropene
TERRACHLOR	pentachloronitrobenze
TERSAN	benomyl
THIODAN	endosulfan
THIRAM	thiram
TILT	propiconazole
TOPAS	propiconazole
TOPAZ	propiconazole
UBI 2732	carbathiin, thiabendazole + metalaxyl
UBI 2722-1	BAYTAN
UBI 2728	carbathiin, thiabendazole, lindane + metalaxyl
UBI2092-1	carbathiin
UBI2379-1	metalaxyl
UBI2383-1	BAYTAN + triadimenol
UBI2584-3	RAXIL
UBI2643	TBZ
UBI2770	carbathiin + thiabendazole + imazalil
VAPAM	metam-sodium
VITAFLO	carbathiin + thiram
VITAVAX	carbathiin
VITAVAX RS	carbathiin + thiram + lindane (gamma BHC)
VYDATE	oxamyl
YF9836	bond adjuvant
ZINEB	zineb